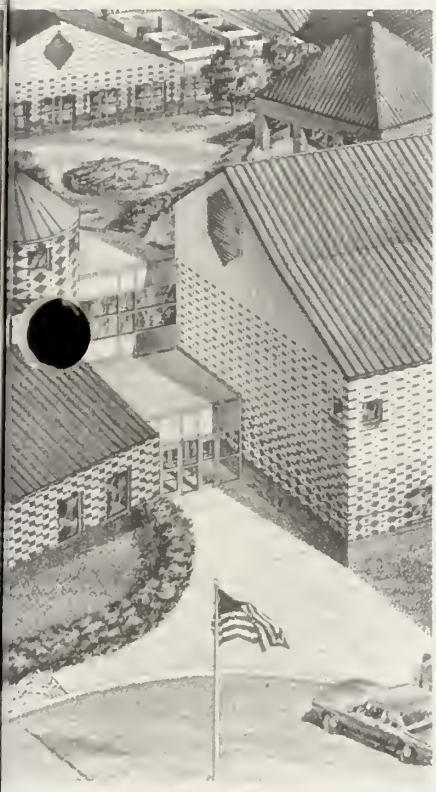
USDA

Agricultural Research Service

Facilities Construction Management Division

Major Facilities Construction Manual

MANUAL 242.4



CONTENTS

ON THE FRONT COVER:
Top Left: Northern Crop Science Laboratory, Fargo, North Dakota
Top Right: Children's Nutrition Research Center, Houston, Texas
Bottom: National Soil Tilth Laboratory, Ames, Iowa

U.S. DEPARTMENT OF AGRICULTURE • AGRICULTURAL RESEARCH SERVICE
WASHINGTON, D.C. 20250

MANUAL 242.4

ORIGINATING OFFICE:	SUBJECT:
Facilities Construction Management Division	Major Facilities Construction Manual
DISTRIBUTION:	
Headquarters, Areas, and Locations	

Remove MANUAL 242.4, dated 7/23/82

A REFERENCE

For objective and policy of Major Facilities Construction project management, see DIRECTIVE 242.4.

B SUMMARY

This manual provides ARS employees a clearly defined process for managing major construction projects. This manual establishes accountability, responsibilities and interactions of key participants in the process. Procedural instructions are available in other Directives, Manuals, etc. (See References at the end of this text.)

C ABBREVIATIONS

Position Titles:

AAO - Area Administrative Officer

ABFO - Area Budget and Fiscal Officer

A-E - Architect-Engineer

AD - Area Director

ADMIN - Administrator

AOE - Area Office Engineer

CIC - Construction Inspection Contractor

CO - Contracting Officer

COR - Contracting Officer's Representative

EPM - Engineering Project Manager

LC - Location Coordinator

LM - Location Monitor

C ABBREVIATIONS (Continued)

NPSR - National Program Staff Representative

PM - Program Manager

PPE - Program Project Executive

PPM - Program Project Manager

RL - Research Leader

Organization Titles:

AM - Administrative Management

ARS - Agricultural Research Service

BPMS - Budget and Program Management Staff

CAD - Contracting and Assistance Division

FCMD - Facilities Construction Management Division

FMD - Financial Management Division

GSD - General Services Division

LS - Legislative Staff

NPS - National Program Staff

OBPA - Office of Budget and Program Analysis

OMB - Office of Management and Budget

D ORGANIZATION OF MANUAL

This manual is organized and presented to parallel the three phases of the major construction process:

I - PLANNING
II - DESIGN
III - CONSTRUCTION

PHASE I: PLANNING

Step 1 - Project Conception

Step 2 - Project Scope Formulation

Step 3 - Appropriation Request and Allocation of Funds

Step 4 - Project Initiation

Step 5 - Project Development

PHASE II: DESIGN

Step 6 - A-E Selection Process

Step 7 - Design Contract Award

Step 8 - Design Contract Administration

PHASE III: CONSTRUCTION

Step 9 - Construction Contract Solicitation and Award

Step 10 - Construction Contract Administration

Step 11 - Final Inspection

Step 12 - Acceptance and Occupancy

Step 13 - Closeout and Warranty

SYNOPSIS OF SIGNIFICANT ISSUES

GLOSSARY

DIRECTIVE AND POLICY REFERENCES

EXHIBITS

E ROLES AND RESPONSIBILITIES

Under each phase, specific responsibilities of the Project Team are discussed. The members of the Project Team are essential for the successful planning and completion of a major construction project. The general roles and responsibilities of each Project Team member are outlined below:

PROJECT TEAM

1 Engineering Project Manager (EPM): The EPM is the project team leader. He/she is an FCMD engineer or architect assigned as the principal representative of ARS interests during planning, design, and construction of the project. He/she provides professional consultation to project team members and other interested Agency personnel. He/she is responsible for overall project management, including budgetary and schedule development and monitoring. The EPM monitors design, provides project information, coordinates reviews, and signs final design documents. The EPM may serve as the Contracting Officer's Representative during construction. He/she makes site visits, coordinates facility inspections, and serves as the principal liaison with the Architect-Engineer, Construction Contractor, Construction Inspection Contractor, and project team members.

2 Program Manager (PM): The AD is usually the PM. The PM has overall project responsibility with appropriate decision making authority (excluding technical engineering, contracting authority and decisions and other administrative decisions). The PM delegates certain operating authorities and responsibilities for the design and construction process but retains final authority for decisions on program and financial issues of the project. The PM, together with the PPM, ensure that the proposed and completed facility satisfies criteria for a usable facility to conduct research and, when applicable, satisfies any special requirements of the Cooperator. The PM is responsible for ensuring compliance with National Environmental Policy Act (NEPA). The PM is the fund holder for the project and is responsible for AD-700 requisition approval and issuance.

3 Program Project Manager (PPM): The PPM is usually the Location Coordinator. The PPM coordinates the project's program requirements to formulate a specific statement of program requirements. He/she serves as the EPM's primary source of information about program criteria and, when applicable, Cooperator criteria, coordinates program review of designs and proposed contract modifications, initials final design documents, and arranges meetings between the EPM and program officials. The PPM is responsible for

E ROLES AND RESPONSIBILITIES (Continued)

signing all levels of design submissions. The satisfaction of research program needs is a major objective throughout the design and construction process.

4 Program Project Executive (PPE): The PPE is usually the Associate Administrator, ARS. The PPE has project oversight responsibility, if assigned by the ADMIN. He/she works and consults with the PM, PPM, and others as designated by the ADMIN. He/she works with the proper officials of the Cooperator, when necessary or appropriate. He/she reviews and approves plans that are developed by personnel of the AM in consultation with the PM and PPM. He/she resolves program and financial disagreements or makes final program and financial decisions when appropriate.

5 National Program Staff Representative (NPSR): The NPSR is usually assigned as the principal Agency representative for providing information regarding the project location's current and projected research mission, program increases, and staffing levels.

6 Contracting Officer (CO): The CO is the only member of the Project Team with authorization to obligate Government funds by contract. This authority is delegated by the Agency Head. He/she is an FCMD staff member. The CO assures contracts are in compliance with regulations and are executed and administered in a fair and equitable environment. He/she is responsible for the business management and coordination of the project from the planning phases through the completion of the project and administrative closeout. The CO monitors performance and budgetary events assuring adequate progression, he/she enforces compliance with contract requirements to protect the Government's interest. He/she conducts conferences, submits report to Congress, makes recommendations regarding reprogramming. The CO is the only one authorized to change contract provisions.

7 Contracting Officer's Representative (COR): The COR is designated and authorized by the CO to monitor performance of A-E contractors and/or construction contractors. His/her duties are outlined in a letter from the CO and may include evaluation of change order requests, recommendations for payment, final inspection, etc. The COR may approve minor changes that do not affect contract price or time. The COR is not authorized to obligate funds, issue time extensions, suspensions of work, terminations or any other action changing the terms of the original contract.

E ROLES AND RESPONSIBILITIES (Continued)

8 General Services Division (GSD) Representatives: Representatives from GSD's Safety and Health Policy Staff Property Management Branch, and Data Administration Branch are responsible for ensuring that the project complies with the criteria and regulations for their respective areas of responsibility.

9 ARS Telecommunications Manager: The ARS Telecommunications Manager (or the designated representative), ADP and Major Equipment Branch, CAD is responsible for ensuring that the project complies with Agency criteria regarding telecommunications.

10 Area Office Engineer (AOE): The AOE is assigned as the technical consultant and resource to the PPM and EPM during the planning, design, and construction of major facilities projects within his/her Area.

11 Architect-Engineer (A-E): The A-E is a private contractor who provides professional services of an architectural, engineering or related nature associated with research, development, design, construction, alteration, or repair of real property and usually required to be performed by a registered or licensed professional architect or engineer. The A-E provides investigative, analytical, design, quality control, project management, inspection, review and consultative services. The A-E may also formally conduct presentations at the various stages of design development and construction, provides complete documentation of all such meetings, informs the EPM of technical problems, provides technical advice and consultation during design and construction, reviews shop drawings, and provides field review services in conjunction with a Construction Inspection Contractor. A separate A-E contractor is also used for Design & Estimate Review Services.

12 Construction Inspection Contractor (CIC): The CIC coordinates construction contract(s) for completion of the construction; inspects work of the contractor(s); coordinates construction with delivery schedules of various equipment manufacturers; coordinates the scheduling and integration of the various phases of construction with the contractor(s), PPM, and EPM/COR; inspects, tests, and approves construction materials and equipment; provides progress reports; resolves minor field situations; approves minor changes that do not affect contract price or time. The CIC is not authorized to obligate funds, issue time extensions, or suspensions of work. The CIC maintains proper contact with the CO, EPM/COR, and A-E. The CIC may be the A-E firm that provided the design.

E ROLES AND RESPONSIBILITIES (Continued)

13 Cooperator: A cooperator is a State or Federal agency or private organization having a mutual interest in agricultural research that has entered into a valid and legal memorandum of understanding, cooperative agreement, long-term lease, or similar document demonstrating that a proposed cooperative effort is of benefit to people of the United States. A cooperator is not always involved in all major construction projects.

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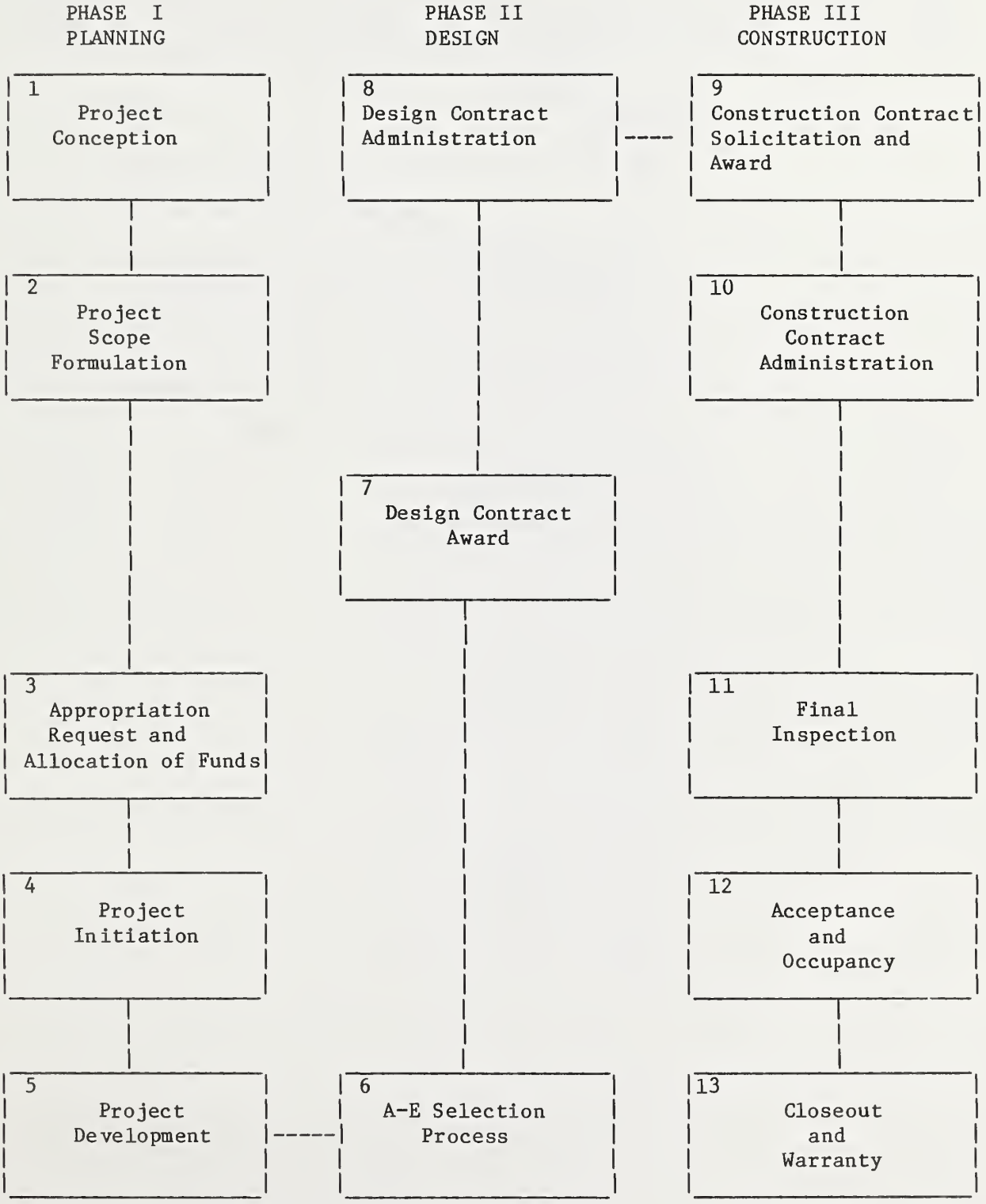
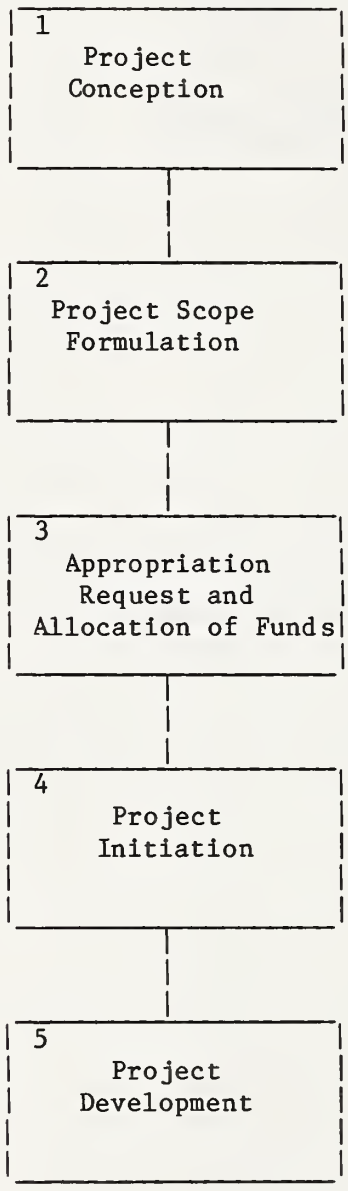
THIS FLOW CHART ILLUSTRATES THE MAJOR CONSTRUCTION PROCESS FROM PROJECT CONCEPTION THROUGH CONSTRUCTION CONTRACT CLOSEOUT. EACH STEP IN THE FLOWCHART IS DISCUSSED IN DETAIL IN THE REMAINDER OF THE TEXT.

MANUAL 242.4



PHASE I
PLANNING



PHASE I
PLANNING

Timeframes

The time involved in the Planning process is difficult to approximate. It is safe to say that each step of the 5-step planning phase will involve a minimum of 30 days. Below is an estimate of the approximate amount of time required to plan a typical major design and construction project.

	Step	Timeframe
(1)	Project Conception	30 days
(2)	Project Scope Formulation	90 days
(3)	Appropriation Request and Allocation of Funds	180 days
(4)	Project Initiation	30 days
(5)	Project Development	60 days

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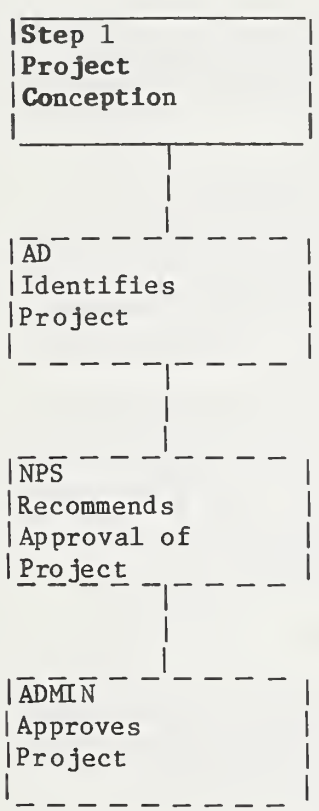
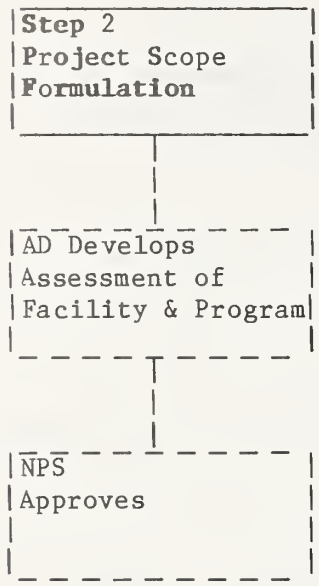
PHASE I - PLANNING



- AD
  - identifies need through the Annual Resource Management Plan (ARMP) process or directly to NPS if project is mandated or initiated at the Congressional level).
- NPS
  - initiates appropriate Congressional contacts
  - recommends approval of project
- ADMIN
  - approves project

PHASE I - PLANNING:



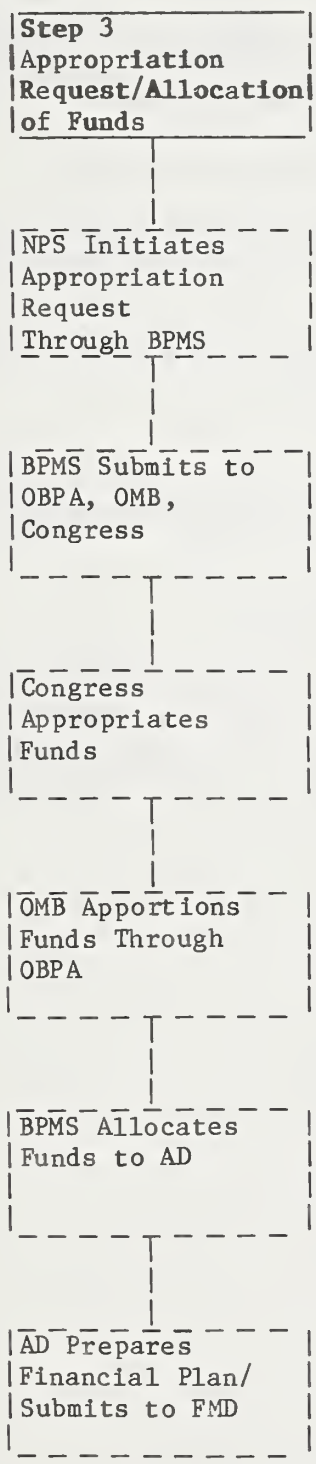
o AD
  o develops Assessment of Facility & Program Needs (See EXHIBIT 1)
    -program mission
    -number of scientist years (SY's)
    -types of space (laboratory, office, support)
    -approximate quantity of space needs in terms of gross square footage of laboratory, office, greenhouse, support, storage, maintenance, etc.
    -fixed equipment needs, i.e., laboratory furniture, growth chambers, fumehoods, etc.
  o selects proposed site
  o develops preliminary assessment of environmental feasibility (program and site)
  o develops and evaluates design alternatives to accomplish mission goals
  o develops estimate of total project budget cost (planning, design, and construction)
  o consults with NPS, FCMD, GSD and incorporates recommendations as appropriate

o FCMD
  o assists in development of preliminary project data, design alternatives, site selection, budget estimate, and schedule and other construction management issues
  o reviews need for contract services for studies (site selection, environmental, estimating)
  o reviews data and makes recommendations

o GSD
  o assists in development of preliminary project data, site selection and other realty issues, environmental and other safety and health issues
  o reviews data and makes recommendations

o NPS
  o provides guidance to AD
  o consults with FCMD and GSD as appropriate
  o reviews and approves preliminary project data, site selection, budget estimate, and justification statement

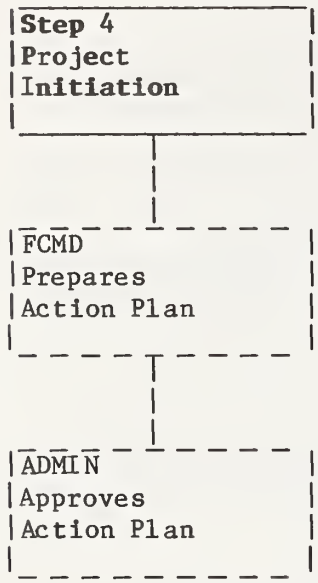
PHASE I - PLANNING:



- NPS
  - initiates appropriation request through BPMS
- BPMS
  - submits project and justification statement to OBPA
  - incorporates as a line item in the ARS budget request
  - serves as liaison with OBPA and Congress
  - coordinates responses to OBPA and Congressional requests
  - receives notice of Congressional and OMB approval through OBPA
  - provides written notification to AD and AM of Congressional authorizations
  - allocates funds to AD and authorizes their use
  - interprets Congressional intent through references to Appropriation Acts, House and Senate Conference Reports, etc.
- OBPA
  - approves project and justification statement
  - incorporates as line item in USDA budget request to OMB
- OMB
  - approves project
  - incorporates as line item in Federal budget request
  - apportions funds, when appropriated, through OBPA
- AD
  - is appointed fundholder for project funds
- AAO
  - coordinates participation of Area Office personnel
  - ABFO prepares and submits financial plan to FMD
  - ABFO establishes and monitors project account

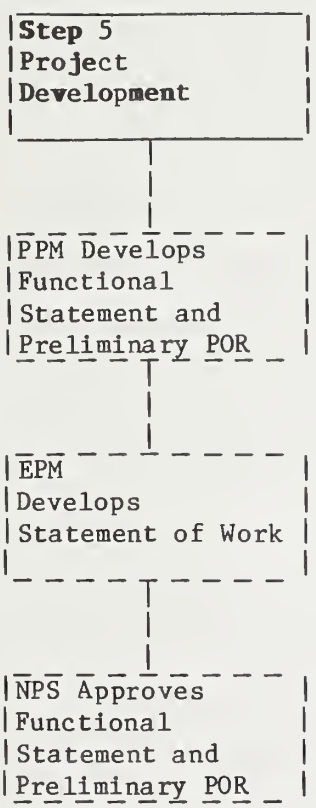
STEP 3 DOES NOT APPLY TO NFMP

PHASE I - PLANNING:



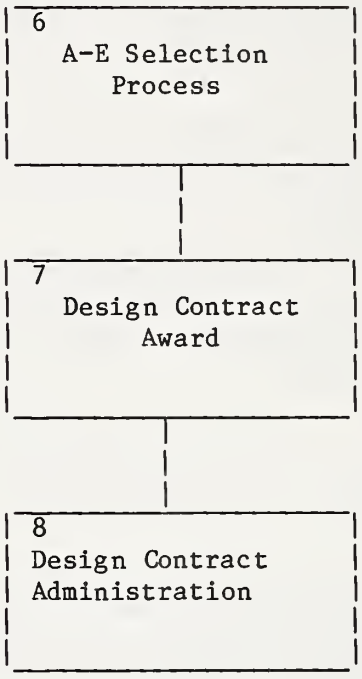
- o FCMD
  - o consults with NPS, AD, and GSD to establish Project Team
  - o prepares written Action Plan (See EXHIBIT 2) identifying Project Team members and defining responsibilities
  - o prepares tentative design and construction schedule for project implementation
  - o prepares preliminary design and construction budget
  - o advises NPS and AD of any schedule or budget concerns
- o NPS
  - o recommends and concurs with Project Team designations
- o AD
  - o is usually appointed PM
  - o selects PPM
  - o recommends and concurs with Project Team designations
- o ADMIN
  - o approves Action Plan

PHASE I - PLANNING:



- o PPM
  - o develops and finalizes Functional Statement (FS) (see EXHIBIT 3)
  - o develops preliminary Program of Requirement (POR) (see EXHIBIT 4)
  - o submits FS and preliminary POR to FCMD through PM and AAO for review
- o EPM
  - o provides sample preliminary POR and FS to PM and PPM
  - o reviews and refines preliminary POR to insure consistency between the project scope and available budget
  - o develops Design Criteria for Statement of Work
  - o sends the preliminary POR to NPS and GSD for review and comment
  - o refines project budget and design and construction schedule
- o CO
  - o assists in refinement of project budget and design and construction schedule
- o GSD
  - o reviews and comments on preliminary POR
  - o begins acquisition of realty interest
  - o assists in preliminary environmental assessment actions
  - o defines leased premises, if applicable
- o AAO
  - o coordinates participation of Area Office personnel
  - o reviews and comments on FS and preliminary POR
- o PM
  - o approves FS and preliminary POR
- o NPS
  - o approves FS and preliminary POR

PHASE II
DESIGN



PHASE II
DESIGN

Timeframes

Activity	Days	Cumulative Time (Months)
Step 6		
Announce Project (CBD)	30	1
Preliminary Evaluation & Report	30	2
Interviews & Report	30	3
Selection Report & Approval	14	3-1/2
Step 7		
Issue RFP to A-E	14	4
Government Legal Review (OGC)	30	5
A-E Prepares Cost Proposal	30	5*
Government Evaluates Cost Proposal	14	5-1/2
Government Prepares Pre-Negotiation Plan	14	6
Cost Audit Performed (DCAA)	30	6*
Negotiation of Cost	14	6-1/2
Summarize Negotiations	14	7
Congressional Notification & Design Award	14	7-1/2
Step 8		
Design (with Design Reviews)		12-18
APPROXIMATE TOTAL TIME PHASE II		20-26 months

*performed simultaneously with preceding activity

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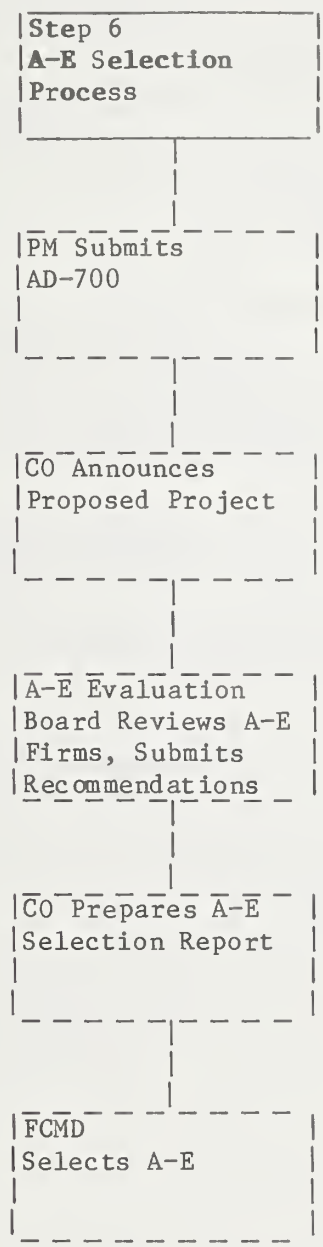
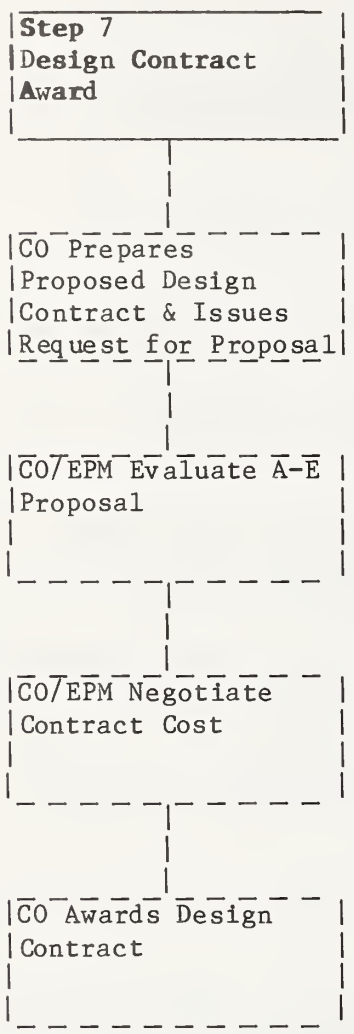
PHASE II - DESIGN



- o PM
  - o submits approved preliminary POR and AD-700 requesting predesign and design services to the CO
- o CO
  - o reviews AD-700 and prepares procurement plan
  - o publicizes proposed project to A-E firms
  - o receives A-E responses
  - o forms and advises A-E Evaluation Board
  - o serves as advisor and non-voting member of A-E Evaluation Board
  - o prepares and submits A-E Selection Report to FCMD Selection Official for approval
- o EPM
  - o prepares and forwards Statement of Work (SOW) including Estimated Construction Cost (ECC)
  - o prepares and forwards estimate of costs for A-E services (predesign and design)
  - o prepares and forwards criteria for evaluation of A-E firms
  - o serves as Chairman and voting member of A-E Evaluation Board
  - o evaluates and interviews A-E firms
  - o prepares and submits final A-E Evaluation Board report and recommendations to CO
- o PPM
  - o serves as voting member of A-E Evaluation Board
- o AAO
  - o coordinates participation of Area Office personnel
  - o AOE serves as voting member of A-E Evaluation Board
  - o ABFO assists PM in AD-700 submission

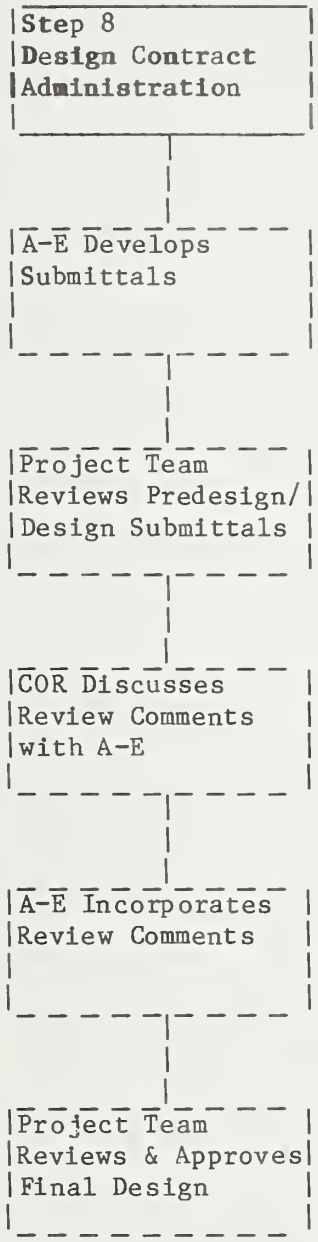
NOTE for NFMP projects: This step may be eliminated by utilizing FCMD's pre-established indefinite quantity A-E contractor.

PHASE II - DESIGN:



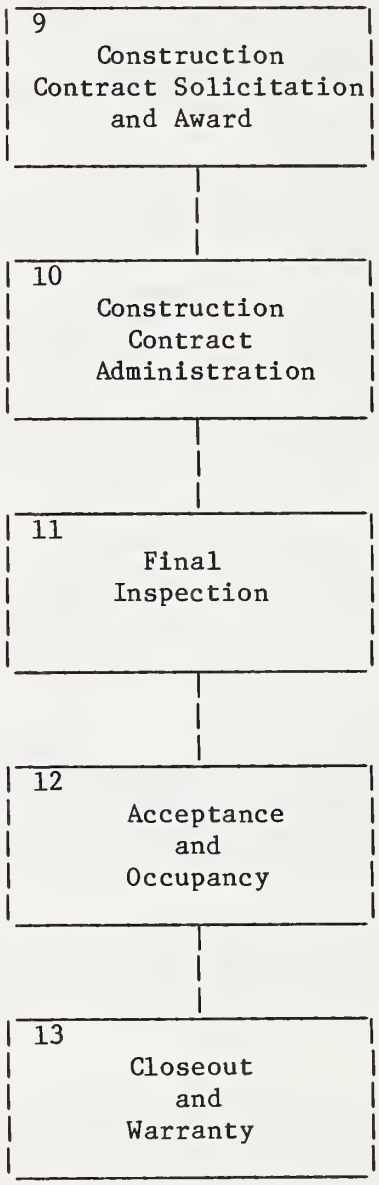
- o CO
  - o prepares proposed design contract (including predesign)
  - o issues Request for Proposal to A-E
  - o obtains legal review and concurrence
  - o obtains audit advice
  - o evaluates A-E proposal
  - o obtains EPM, PPM, PM, AOE advice as required
  - o negotiates A-E design contract
  - o notifies LS, FMD, ABFO prior to award
  - o awards design contract
  - o notifies and debriefs unsuccessful firms
- o EPM
  - o assists CO in evaluation of A-E proposal
  - o provides and coordinates technical assistance and price support to CO during negotiations with A-E
- o GSD
  - o finalizes realty acquisition prior to design award
- o PPM
  - o may provide program assistance during negotiations with A-E
- o PM
  - o resolves program discrepancies if necessary
- o AAO
  - o coordinates participation of Area Office personnel
  - o AOE assists PPM if necessary
  - o ABFO begins maintenance of project account

PHASE II - DESIGN:



- o CO
  - o appoints COR
  - o negotiates and awards Design Review Contract
  - o reviews A-E submissions
  - o monitors compliance with contract provisions/schedules
  - o coordinates 50% Design Review Board activities
  - o evaluates and authorizes contract changes
  - o resolves contract disputes
  - o approves contractor payments
  - o accepts final design
  - o requests and reviews Performance Evaluation Reports
- o EPM (COR)
  - o may serve as COR for design and design review contracts
  - o prepares Statement of Work (SOW) for Design Review
  - o provides and coordinates technical assistance/price support to CO during negotiations with Design Review contractor
  - o prepares Performance Evaluation Reports
  - o coordinates design reviews
  - o approves predesign/design submittals, cost estimates, etc.
  - o reviews and recommends proposed changes
  - o recommends payment of contractors' invoices
  - o approves final design
- o A-E Design Contractor
  - o develops final POR
  - o prepares various predesign/design submittals and cost estimates including Bid Alternates, if necessary
- o PM
  - o submits AD-700 for Design Review Contract
  - o makes decisions on environmental documentation
  - o resolves and approves program deviations
  - o reviews and comments on predesign/design submittals
  - o approves final POR and final predesign/design
- o PPM
  - o assures that final POR complies with program
  - o assures that design complies with approved POR
  - o reviews & approves predesign/design submittals/final design
- o AAO
  - o coordinates participation of Area Office personnel
  - o AOE assists in design reviews
  - o ABFO monitors status of project funds
- o GSD
  - o reviews and comments on predesign/design submittals
- o CAD (Telecommunications Manager)
  - o reviews and comments on predesign/design submittals
  - o provides advice on telecommunication system installation
- o Design Review Contractor
  - o assists Project Team in Design and Estimate Review

PHASE III
CONSTRUCTION



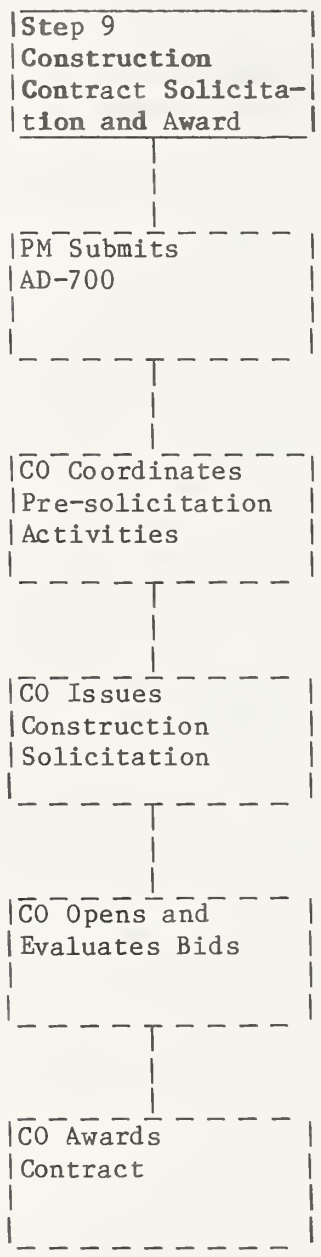
PHASE III
CONSTRUCTION

Timeframes

Activity	Days	Cumulative Time (Months)
Step 9		
Presolicitation Activities (CBD notice, etc.)	30	1/2*
Solicitation Period (issue and open bids)	45	2
Evaluation of Bids (preaward survey, etc.)	14	2-1/2
Award (Notify Congress, process contract, exercise A-E options)	14	3
Step 10		
Bonds (Receive from contractor)	14	3-1/2
Notice to Proceed (process & issue)	14	4
Begin Construction (Contractor to mobilize)	14	4*
Complete Construction (18 months from notice to proceed)	540	22
Step 11 Punchlist Completion	30	23
Step 12		
Occupy Facility	14-30	24
APPROXIMATE TOTAL TIME (PHASE III)	720	24 months
Step 13		
Closeout of Contract	N/A	N/A

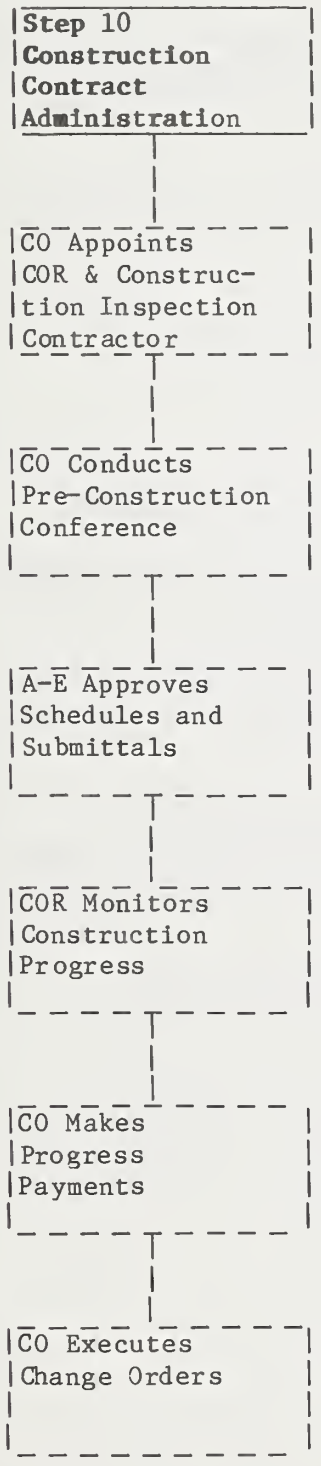
*may be partially performed simultaneously during Phase II - Design, Step 8.

PHASE III - CONSTRUCTION



- o PM
  - o submits AD-700 to CO
- o EPM
  - o forwards approved specification, drawings, cost estimate, etc. to CO
  - o assists in prebid conference
  - o coordinates and approves technical aspects of solicitation amendments
  - o assists in evaluation of bids as necessary
- o CO
  - o reviews AD-700 and issues procurement plan
  - o publicizes project in Commerce Business Daily
  - o coordinates presolicitation activities
  - o prepares solicitation and coordinates issuance
  - o conducts pre-bid conference
  - o receives and evaluates bids with assistance of EPM/A-E
  - o prepares construction contract award determination
  - o notifies PM, LS, BPMS, NPSR, FMD, ABFO of award
  - o awards construction contract
  - o notifies unsuccessful bidders
  - o synopsizes contract award in Commerce Business Daily
- o PPM
  - o participates in prebid conference
  - o approves program aspects of solicitation amendments
  - o coordinates ceremonial activities
- o AAO
  - o coordinates participation of Area Office personnel
  - o ABFO assists PM in AD-700 submission
  - o AOE participates in pre-bid conference and assists in technical review of solicitation amendments
- o A-E
  - o assists in reproduction and distribution of solicitation
  - o assists in prebid conference
  - o prepares and distributes solicitation amendments
  - o performs other bid phase services as required
  - o provides written responses to bidders' questions
  - o corrects specifications and drawings as necessary

PHASE III - CONSTRUCTION:



o CO
- o appoints COR and designates Location Monitor
- o negotiates and awards construction inspection contract
- o conducts preconstruction conference and attends meetings
- o evaluates, negotiates, and executes change proposals
- o monitors compliance with contract provisions/schedules
- o approves contractor payments
- o resolves disputes and issues final decisions

o EPM (COR)
- o may serve as COR for the construction and inspection contracts
- o prepares SOW for construction inspection contract
- o provides and coordinates technical assistance and price support to CO during negotiations with CIC
- o participates in project meetings
- o monitors construction progress and prepares reports
- o coordinates activities of A-E firm and CIC
- o reports progress and/or problems to CO and PPM
- o makes recommendations on contractor's payment requests
- o reviews and recommends proposed change orders

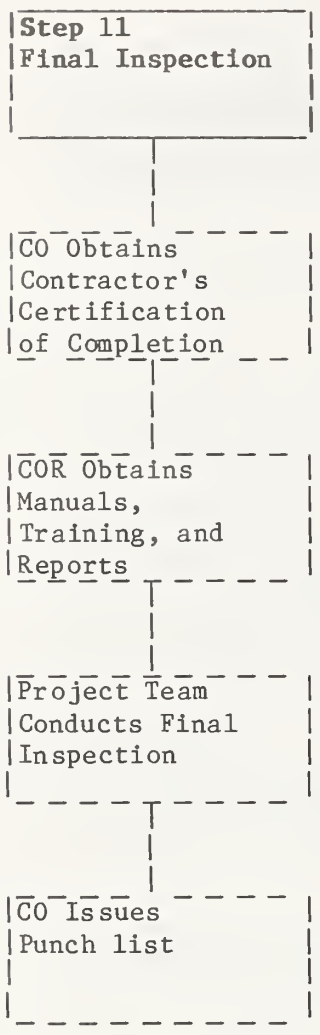
o PM
- o is accountable for funds expended on project
- o resolves and approves program deviations
- o concurs in necessity for change orders via telemail

o PPM
- o participates in project meetings
- o is continuing source of program criteria information
- o concurs in necessity for change orders

o AAO
- o coordinates participation of Area Office personnel
- o approves designation of Location Monitor
- o ABFO monitors status of project funds
- o implements PM change order decisions via telemail funds

o A-E Firm and/or CIC
- o approves shop drawings, submittals, and schedules
- o coordinates and reports on project meetings, tests, and inspections
- o notifies COR/CO of progress and/or problems
- o provides progress reports to COR/CO
- o provides cost estimates for proposed contract changes
- o reviews contractor invoices and provides recommendations
- o provides technical advice/consultation on design intent

PHASE III - CONSTRUCTION:



o EPM/COR
  o obtains Operation & Maintenance (O&M) Manuals, warranty documentation, HVAC system test and balance reports, and as-built drawings prior to final inspection
  o participates in final inspection
  o provides recommendations of time required for punch list completion

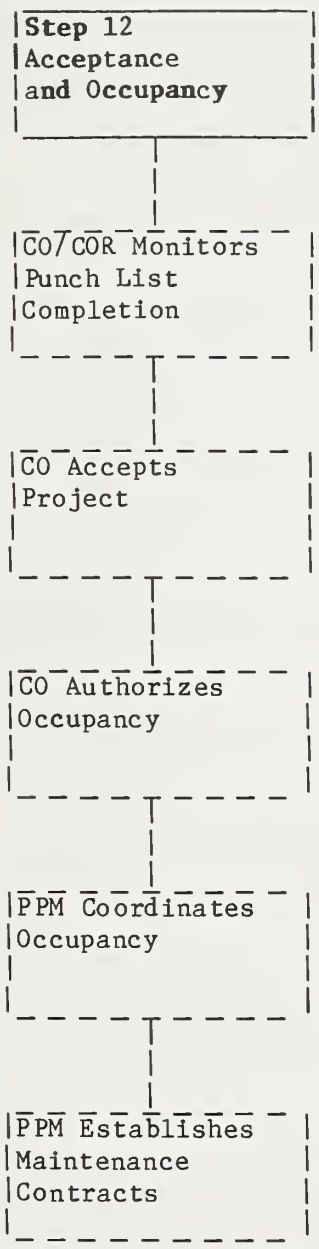
o PPM
  o verifies that construction contractor has provided instruction, training and demonstration to key personnel on use of equipment
  o participates in final inspection

o A-E
  o verifies that project is ready for final inspection
  o reviews and processes O&M Manuals, warranty documentation, test and balance reports, as-built drawings
  o conducts final inspection
  o records deficiencies during final inspection
  o provides official punch list to CO
  o provides recommendation of time required for completion of punch list items

o CO
  o obtains written certification from construction contractor that project is complete and ready for final inspection
  o establishes final inspection date
  o participates in final inspection
  o notifies contractor of official punch list items
  o specifies date for completion of punch list items

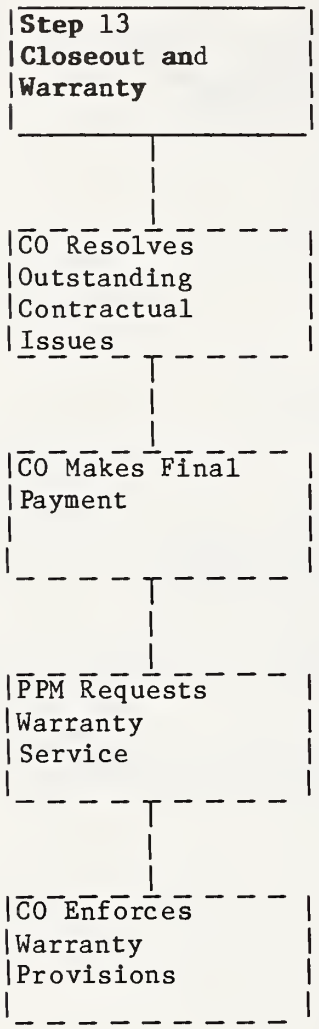
o AAO
  o coordinates participation of Area Office personnel
  o AOE participates in final inspection

PHASE III - CONSTRUCTION:



- o CO
  - o monitors completion of punch list
  - o officially accepts project and authorizes occupancy upon completion of punch list
- o EPM/COR
  - o monitors completion of punch list
  - o notifies CO of punch list completion
  - o recommends acceptance of project
- o A-E
  - o monitors punch list completion
  - o advises CO of punch list completion
  - o recommends acceptance of project
- o PPM
  - o coordinates occupancy of facility
  - o arranges for establishment of maintenance contracts for facility systems and equipment with Area Office
  - o coordinates ceremonial activities
  - o recommends acceptance of project
- o AAO
  - o coordinates participation of Area Office personnel

PHASE III - CONSTRUCTION:



- o CO
  - o finalizes outstanding contract change orders
  - o reconciles financial matters
  - o obtains release from claims
  - o provides instructions on warranty issues
  - o notifies ABFO of closeout
  - o requests and reviews Performance Evaluation Reports (for A-E and construction contractors)
  - o processes final payments
  - o forwards letters of completion to PM, COR, A-E
  - o recommends preparation of reprogramming request
- o PM
  - o is responsible for accounting closeout activities
  - o is responsible for reprogramming recommendations to BPMS and FMD
- o PPM
  - o advises CO of project completion and acceptability
  - o makes direct contact with subcontractors and suppliers when systems and equipment require service under warranty provisions
  - o notifies CO of contractor's failure to respond to warranty calls
- o A-E
  - o submits Record Drawings to Government
  - o reviews and recommends final payment to construction contractor
- o EPM/COR
  - o prepares Performance Evaluation Reports
  - o reviews and recommends final payment to A-E and construction contractor
- o AAO
  - o coordinates participation of Area Office personnel
  - o ABFO coordinates accounting closeout activities and prepares submission for reprogramming activity if necessary
  - o AOE accepts Record Drawings

SYNOPSIS OF SIGNIFICANT ISSUES PERTINENT TO THE PLANNING, DESIGN, AND CONSTRUCTION PROCESS

There are many important requirements, regulations, policies, and procedures applicable to major facility design and construction projects. The following synopsizes those significant issues which are of particular importance to ARS design and construction projects.

- Project Budget Elements
- Usable Facility
- Realty Interest
- Cooperator/Lessor Participation
- A-E Selection
- 15% Design Submission (Conceptual Presentation)
- Review of A-E Design Submittals
- Ceremonial Activities
- Construction Inspection
- Use of Facility Prior to Completion
- Contract Closeout

PROJECT BUDGET ELEMENTS

There are various expenditures necessary to carry-out the design and construction of a major facility construction project. These expenditures are for (1) A-E services, (2) construction of the building including fixed equipment (commonly called brick and mortar) and, (3) contingency items (change orders due to unplanned or unforeseen issues, etc.). Below is a listing of the various elements of cost which represent a typical design and construction project.

BUDGET ELEMENTS

Planning & Design

	% of Total Budget
o POR Finalization	2
o Environmental Assessment	2
o Design	6
o Design Review	2
o Design Contingency	1
o Travel	1
o Miscellaneous (Renderings, etc.)	1
TOTAL	15%

Construction

o A-E Bid Phase Services	1
o Construction of Facility & Fixed Equipment	74
o Inspection	2
o A-E Approval Services	3
o Construction Contingency	5
TOTAL	85%

NOTE: See following example based on a $10,000,000 appropriation for design and construction.

BUDGET ELEMENTS

(Example Based on a $10,000,000 Appropriation for Planning/Design/Construction)

Phase	% of Total Appropriation	Amount
Planning & Design		
--POR Finalization	2	$200,000
--Environmental Assessment	2	200,000
--Design	6	600,000
--Design Review	2	200,000
--Design Contingency	1	100,000
--Travel	1	100,000
--Miscellaneous	1	100,000
--TOTAL Planning & Design	15%	$1,500,000
Construction		
--A-E Bid Phase Services	1	$100,000
--A-E Inspection Services	2	200,000
--A-E Document Approval	3	300,000
--Construction Contingency	5	500,000
--Construction of Facility & Fixed Equipment	74	7,400,000
--TOTAL Construction	85%	$8,500,000

USABLE FACILITY

The facility must be a stand alone structure which is detached from buildings not owned by the Agency. The facility must have sufficient usable space to permit the Agency to conduct the research program defined in the functional statement. The completed facility should include the construction of the necessary buildings and other structures needed to support the planned research.

Laboratories, offices, and other buildings and structures must contain, as part of the design and construction plans, the complete installation of the necessary and fully operational utilities (i.e., heat, light, power, telecommunications, ventilation, air-conditioning, safety and health systems). The rooms in such structures must contain the necessary fixed equipment, cabinets, benches, and other items which are permanently attached to the building and capitalized as part of the building or structure.

Special purpose space and utility rooms must contain the necessary safety devices, utility systems, and other fixed equipment necessary for the facility's satisfactory operation.

Support structures and buildings, such as greenhouses, headhouses, repair shops, animal facilities, and storage facilities must be completed to the extent that requirements are known during the planning stages (including heating, air-conditioning, ventilation, safety considerations, provision for appropriate water, gas and other utility hookups). The facility must include necessary sidewalks, roads, vehicle parking spaces, and landscaping.

REALTY INTEREST

A contract for design of a major facility cannot be awarded unless ARS has a sufficient realty interest in the land upon which the facility will be built. Realty interests are in the form of fee simple ownership, long-term lease agreements, and easements (for utilities and road construction).

The Administrator is the Government official delegated the authority to execute the agreements to acquire realty interests. GSD is charged with the responsibility of determining the type of estate to be acquired and negotiating the real estate agreements to be executed by the ADMIN.

The real estate acquisition process can be a very complex and lengthy process quite often involving 9-12 months to complete. It is necessary, therefore, that the AD/PM involve GSD as early as possible in the planning process so as not to delay the acquisition. It is highly recommended that the process of involving GSD begin during preparation of the Annual Resource Management Plan (ARMP) process.

The following are steps taken by GSD in a real estate acquisition:

- Obtaining a boundary survey, legal description, and survey map or drawing.

- Obtaining a preliminary title report and final title insurance from a Department of Justice-approved title company.

- (For fee simple land acquisitions) Obtaining an appraisal report from an appraiser/appraisal firm with a designation from Member of the Appraisal Institute, Society for Real Estate Appraisers, or other nationally recognized organizations.

- Preparation of appropriate environmental documentation including, for National-Register properties, preparation of historical survey documentation.

- Preparation of Real Estate Documents.

COOPERATOR/LESSOR PARTICIPATION

The following are some of the project issues in which the Cooperator/Lessor usually becomes interested or involved.

- Schedules: The terms of the lease cannot dictate Government time schedules which are otherwise prohibited by Federal Acquisition Regulations or policy.

- Funds: The terms of the lease cannot dictate Government budgets or Government financing of improvements beyond the boundaries of the leased premises except as documented through appropriate conveyances or easements.

- Utilities: Consideration is given to the availability and access of utilities and telecommunications through systems existing through the Cooperator/Lessor. During the design phase, calculations are made to determine the economy of accessing and utilization of Cooperator/Lessor vs. public utilities. Utilization of utilities will be stipulated in the lease.

- Design Review: The Cooperator/Lessor may have the opportunity to review and comment upon the various design submittals within the Government timeframes. The Cooperator/Lessor is often interested in the architectural and landscaping compatibility of the facility to the surrounding facilities, site orientation, pedestrian and vehicular traffic patterns, existing vegetation and historic preservation.

  The Cooperator/Lessor has no approval authority over design, specifically in the areas of program, mechanical design and electrical design, space layout, etc.

- Construction Inspection: The Cooperator/Lessor may have access to the construction site for observation; but is not accountable for project inspection or acceptance.

A-E SELECTION

Public Law 92-582, the Brooks Act, is the Federal Government policy for procuring architectural and engineering services. It allows the Government to evaluate the qualifications and performance of A-E firms and conduct discussions to select the firm deemed to be most highly qualified. The Agency is then authorized to negotiate a contract with the most highly qualified A-E firm for a compensation determined fair and reasonable by the Government.

Certain definitive procedures are prescribed in the Federal Acquisition Regulations to promote competition and fairness in this process.

15% DESIGN SUBMITTAL (CONCEPTUAL PRESENTATION)

This is a very important and interesting step to all of those involved in the project.

The A-E design firm makes formal presentations of at least 3 alternate design schemes which successfully integrate interior and exterior design elements with program function.

Each conceptual presentation consists of:

1. Proposed "footprint" of the facility and orientation of the building on the site and associated site development considerations for each scheme.

2. Schematic floor plans depicting proposed spatial relationships to required functional relationships for each scheme.

3. Exterior elevations depicting architectural materials and elements for each scheme.

4. Cost estimates for each scheme considering life cycle cost analysis of proposed building systems (structural, mechanical, electrical) and exterior envelope.

The decision made as a result of the conceptual presentation defines the direction in which the A-E will proceed to further develop the design within required budgetary, technical, and programmatic restraints in a functional, aesthetic and cost effective manner.

REVIEW OF A-E DESIGN SUBMITTALS

It is critical for the Government to assure that completed A-E designs are "constructable," designed within the project budget, meet all applicable codes and standards, i.e., Life Safety Codes, Occupational Safety & Health Administration Standards and result in a "usable facility." Through an independent A-E Design Review Contract and the FCMD review processes, the Government is further assured that completed designs can be constructed within budget and with minimal design deficiencies.

The following is a description of these functions:

1. Design Review Contract - An A-E contractor (other than the designer) who is responsible for the review of design submittals and cost estimates. This function supplements the review of design submittals and cost estimates performed by other reviewing officials. An independent cost estimate can also be obtained if appropriate.

2. Design Review Board - The 50% Review Board is an internal FCMD procedure which requires a management review of the A-E's cost estimate at the 50% stage of design completion to assure that the project construction cost remains within the specified budget.

If the review process indicates that the design and/or project costs are not in accordance with the approved POR and/or specified budget, or if there is a decision to change the scope of the project, the design A-E firm corrects the project design to be consistent with the POR or revises the project design to reflect authorized changes in scope.

CEREMONIAL ACTIVITIES

Ceremonial activities are often considered appropriate for major projects, especially when specific Congressional appropriations are involved. The types of activities that have been conducted are groundbreaking ceremonies and dedications.

The PM, AD, PPM or Location Leader assumes the responsibility for planning these activities through the Legislative Staff (LS). The LS coordinates appropriate Congressional participation.

Discussions should be initiated with the LS sufficiently in advance of the activity to obtain their recommendations and Congressional coordination.

The planning time involved is a minimum of 60 days to assure coordination with the Congressional calendar. Specific dates for events cannot be predetermined by ARS. The availability of Congressional participants is the determining factor in the establishment of the date of the ceremonial activity.

CONSTRUCTION MONITORING, INSPECTION, REPORTING

The following personnel are involved frequently, often daily, with the construction activity and provide varying degrees of coordination. All are responsible for alerting the Contracting Officer (CO) or the Contracting Officer's Representative (COR) of existing or potential problematic situations.

Contracting Officer's Representative (COR) - The COR is an individual designated by the CO to monitor performance of the construction contractor and/or the A-E contractor.

The COR is usually the EPM, qualified ARS Engineer, or another person who is qualified and can officially dedicate time to this role.

Construction Inspection Contractor (CIC) - Inspection of ARS construction projects is usually accomplished by on-site A-E contractors. Full-time inspection is usually required for jobs of the size and complexity of major construction.

The CIC becomes the "eyes and ears" of the COR to ensure that the construction is accomplished in accordance with contract plans and specifications. The CIC provides reports to the COR regarding construction progress, problems, etc.

Other A-E Construction Phase Services: The A-E construction phase contacts have provisions for providing the required professional testing services, providing clarifications of design intent, recommending and reviewing change order proposals (including price), or providing professional advice on specific or sensitive/problem areas.

Location Monitor (LM) - ARS representative at the construction site (or nearby location) who serves as a point of contact for either the A-E, CIC, or the construction contractor to provide information regarding Location rules and regulations of conduct. The LM is expected to notify the COR or the CO if he/she becomes aware of unusual or important circumstances pertinent to the contract. LM has no responsibility for contractor inspection or supervision and is not expected to evaluate contractor performance. Examples of the situations in which LM may get involved are: (1) designating parking areas for contractor's employees; (2) coordinating usage of Government facilities, restrooms, and utilities; (3) coordinating authorization for contractor to work beyond normal working hours. The LM designation which is approved by the AAO is normally made to the location maintenance engineer, Location administrative officer, or LC.

USE OF FACILITY PRIOR TO COMPLETION

There is a legal contractual right to occupy and use a facility before all construction work is completed and before the facility is fully accepted and fully paid for by ARS. The Contracting Officer (CO) must approve and authorize this activity.

Use and occupancy can occur only if the facility is "substantially complete", which means the space can be occupied and utilized for its intended purpose.

The CO will not consider the facility "substantially complete" nor authorize use of the facility prior to completion unless the following conditions are met:

- o all major equipment is satisfactorily installed, tested, certified, balanced, and operating properly
- o all major building systems (HVAC, water and sewer, etc.) are satisfactorily installed, tested, balanced and operating properly
- o all major safety systems (fumehoods, fire alarms, fire suppressor systems, etc) are satisfactorily installed, tested, certified, balanced and operating properly.
- o uncompleted work is of a minor nature (i.e. paint touchup, ceiling/floor tile defects, door/window work, landscaping, etc.)

CONTRACT CLOSEOUT

The purpose of the contract closeout process is to assure accomplishment of the following in accordance with Federal Acquisition Regulations.

- o Verification that all contract requirements have been meet, all documentation received, as-built drawings, operation and maintenance manuals and warranty documents delivered to the appropriate recipient.
- o Assurance of completion of Performance Evaluation Reports by COR.
- o Notification to advise Facility direction of identification of warranty items and expiration dates for Location utilization.
- o Notification to construction contractor of identified warranty items and expiration dates; and that warranty administration has been delegated to a location representative.
- o Availability of Contracting Officer to resolve warranty response problems and to follow-up with Location prior to warranty expiration dates.

GLOSSARY

AD-700: Requisition form required for requesting design, construction and related services. Data includes description of work, amount of funds, accounting and appropriation information, suggested source of supply, and signature of fund holder.

A-E Evaluation Board: An Agency-designated committee of at least three voting members, who evaluate all A-E submissions (SF-254's and SF-255's) and interviews to determine qualified firms for recommendations to the A-E Selection Authority. The Chairperson of this committee shall be the EPM. The designated project CO shall be a nonvoting member who acts in an advisory capacity.

A-E Selection Official: Director, FCMD, or Chief, FCB, who reviews and approves the recommendations of the CO and the A-E Evaluation Board.

A-E Services: Professional services of an architectural or engineering nature associated with research, development, design, construction, alteration, or repair of real property that are required by law to be performed by a registered or licensed architect or engineer or such other services as described in the Federal Acquisition Regulations.

Alternative Methods of Accomplishment: Other means of satisfying the facility/mission need. Change in utilization of existing facilities, contracting, cooperative agreement, use of surplus space, leasing existing facilities, build-lease, new construction, and phased construction are explored, to name a few alternatives to be considered.

Apportionment: Approval by the Office of Management and Budget of the total funds available for construction based on an appropriation. Construction funds are apportioned on an annual basis for the full amount available. The amount of funds apportioned sets the limit on the amount available for allocation.

Appropriation: Statutory authority for ARS to incur obligations and make payments in specific amounts and for specific construction projects. The amount of funds available for each construction project becomes the legal dollar limitation for fund control under Antideficiency Act regulations.

Bid Alternates: Alternate work items in the solicitation which are added or deleted from contract award based on availability of funds or alternative method for accomplishing part of the work specified (alternates must be listed in order of priority). Generally, bid alternates are additive rather than deductive. Exclusion of alternates from a contract award must still result in the end product meeting the usable facility definition.

Categorical Exclusion (CATEX): The environmental review-finding that a proposed action is described by a USDA or ARS CATEX category and has no potential to significantly affect the environment or be controversial. NFMP projects involving one-for-one replacement and no new programming may be subject to a CATEX. New facilities are not subject to CATEX.

Change Request/Change Proposal: Verbal or written request to Contracting Officer from Construction Contractor, A-E, EPM, Program official, or COR, to modify the terms of the contract. (See Contract Modification.)

Congressional Intent: Identifies the purposes of the funds appropriated, such as the nature of the buildings, facilities, support structures and systems, furniture, utilities, roads, parking lots and grounds necessary for a completed facility usable for conducting the intended research for which the funds were provided. Principal sources of Congressional intent are functional statement, program of requirements, justification statement, House and Senate subcommittee hearings and testimony, and conference committee reports. Clarification and understanding of Congressional intent is essential before beginning the construction project.

Construction: Any construction, alteration, or repair (including dredging, excavating, and painting) of buildings, structures, or other real property. For purposes of this definition the terms "buildings, structures, or other real property" include, but are not limited to, improvements of all types, such as bridges, dams, power plants, highways, parkways, streets, subways, tunnels, sewers, mains, power lines, cemeteries, pumping stations, railways, airport facilities, terminals, docks, piers, wharves, lighthouses, buoys, jetties, breakwaters, levees, canals, and channels.

Construction Plans/Drawings: A two-dimensional graphic representation of the design, location, elements, and dimensions of a project, normally seen in a horizontal plane viewed from above; but also, containing details, sections, legends for symbols, abbreviations, and materials, and special tables called "Schedules" which identify doors, windows, hardware, mechanical and electrical equipment, and finishes. Drawings are fully detailed, accurately dimensioned, and cross-referenced.

Construction Specifications: Written descriptions of a technical nature of materials, equipment, construction systems, standards, and workmanship.

Construction Inspection: A process in which the Government, an Architect-Engineer firm, CIC, or others inspect work of the construction contractor(s); inspect, test, and approve construction materials and equipment; and/or perform other designated services for the Contracting Officer.

Contingency Funds: Funds set aside prior to or upon award of a construction contract to use for modifications resulting from changes in the drawings, specifications, site conditions, etc., or for any required special testing. In special purpose facilities or renovations, contingencies could be equivalent to 10 percent of the construction contract cost. In new facilities contingencies may be 5 percent of the construction contract cost.

Contract Modification: General term which includes any written alteration of the contract documents for change of location of performance, rate of delivery or performance, contract period, price, quantity, or other contract provision of an existing contract whether accomplished by unilateral actions, such as change orders, notices of termination, and notices of the exercise of an option, or bilateral action, such as supplemental agreements. Only the Contracting Officer has authority to modify the contract.

Design: That phase of facility development activity which transforms programming data (POR) into architectural and engineering concepts resulting in a set of construction contract documents which permit construction bids to be solicited, received and evaluated. These documents are generally special contract provisions, plans (drawings), and technical specifications.

Design Review Contractor: A private contractor, usually an A-E firm, who provides professional services for an independent technical review of design documents (plans and specifications) and Estimated Construction Cost (ECC) for conformance to the requirements.

Environmental Assessment (EA): A public environmental document that is prepared prior to an Agency's decision to prepare an EIS or a FONSI for a project/proposed action. An adequate EA facilitates considerations of environmental factors and incorporates measures to mitigate or minimize the environmental impact of the proposed action.

Environmental Impact Statement (EIS): A detailed document presenting an evaluation and analysis of all relevant factors where a determination is made that a proposed ARS action may significantly affect the quality of the human environment. EIS is required by the National Environmental Policy Act of 1969.

Estimated Construction Cost: All labor, material, and fixed equipment costs associated with actual onsite construction of the facility.

Finding of No Significant Impact (FONSI): A public document declaring that the decision maker has evaluated the potential environmental impacts of a proposed action and any related/connected actions identified by a qualified individual, and found them to be insignificant.

Fixed Equipment: Permanently installed and affixed equipment such as air conditioning equipment, fume hoods, laboratory casework, water coolers, cage washers, and similar equipment which is normally capitalized as part of the building or structure. These items are normally part of the construction contact. (Does not normally include portable scientific apparatus.)

Functional Statement: A detailed description of the activities to be performed at a facility. This includes an organization breakdown, program objectives, summary of functions and major scientific equipment to be used by each organizational element, relationships among the various organizational elements, location and siting criteria, exposure to the public and other groups, logistical needs, staffing, and any other factors which will influence facility design.

Geotechnical Survey: An investigation of soils or rock strengths, stability, settlement characteristics.

Justification Statement: Part of the Budget Explanatory Notes, in support of the Budget Estimates, sent to the House and Senate Appropriations Committees, describing requests for construction funds. The amount of funds for each construction project is identified for land acquisition, planning and design, and construction with a description of the types of research to be conducted, the reasons the research is essential, identification of the research objectives to be achieved, gross square footage requirements, and the nature, condition and location of any facilities currently used to perform similar research.

Life Cycle Cost Analysis: The total cost of owning, operating, and maintaining a building over the length of its useful life, including its fuel and energy costs, determined on the basis of a systematic evaluation and comparison of alternative building systems.

Mission: The broad research goals to be attained as a result of the research program planned to be performed within the facility.

Planning: General term for the project phase which includes development of the program of requirements, design criteria, budget, site selection, and general project design.

Prebid/Preproposal Conference: A forum prior to bidding in which the Contracting Officer and other interested Agency personnel explain to potential bidders the nature of the work and known problems. The A-E assists in interpreting the plans and specifications. (This meeting is known as preproposal conference in negotiated procurements.)

Preconstruction Conference: A forum after contract award, in which the Contracting Officer, other Project Team members, and the construction contractor meet to discuss mobilization, construction scheduling, authorities of Government personnel, progress reports, inspection rights of parties, payroll submissions, payment procedures, EEO responsibilities, change order procedures, etc.

Predesign: The phase of planning and design in which required preliminary activities such as POR finalization, preliminary surveys (i.e. geotechnical, topographical, asbestos, environmental) and preliminary cost estimates are developed and approved.

Procurement Plan: A format for identifying milestones of the acquisition process and projected dates.

Planning: General term for the project phase which includes development of the program of requirements, design criteria, budget, site selection, and general project design.

Prebid/Preproposal Conference: A forum prior to bidding in which the Contracting Officer and other interested Agency personnel explain to potential bidders the nature of the work and known problems. The A-E assists in interpreting the plans and specifications. (This meeting is known as preproposal conference in negotiated procurements.)

Program of Requirements (POR): A detailed document of the characteristics that a proposed facility must contain to meet the needs of the occupying organization. It is generally divided into two parts: the Functional Statement which provides a basis for review and justification of the program by the Agency, Department, OMB, and Congress; and the SOW which includes facility space planning data and budget estimates used as a basis for the design contract.

Project Budget Cost: All costs associated with project implementation, e.g., pre-design, design, design review, A-E bid phase, inspection, construction, and travel of ARS personnel. (See Total Project Cost.)

Punch List: A list of defects and omissions officially developed at the final inspection which require completion or correction by the construction contractor.

Record Drawings: Drawings which have been marked-up by the construction contractor to indicate actual changes, revisions, deviations, and additions to the original intention of the construction drawings. The construction contractor's "marked-up" drawings are submitted to the A-E after final inspection for verification. The A-E transcribes all changes onto the reproducible materials which will be submitted to the Government for permanent record.

Square Footage, Gross: The total area of the building, including all operating floors, mechanical spaces, basement spaces, and covered outdoor space, used in cost estimate calculations.

Square Footage, Net: The total usable space of a facility, not including stairways, general corridors, and mechanical spaces, used in planning and programming.

Statement of Work: A translation of the Program of Requirements into architectural and engineering technical requirements which serves as the scope of the design contract and provides sufficient information for an A-E firm to develop a proposed fee. Design criteria may also be referred to as the Statement of Work.

Topographic Survey: A drawing showing site landscape conditions, by means of contour lines indicating heights above or below a fixed datum.

Total Project Budget Cost: An estimate of the total of all facilities project related costs including planning costs, environmental/archeological impact funds, site acquisition and clearance costs, works of art, the cost for utility and other agreements, technical services, contingency reserve, Government costs, etc., and the base construction cost, all adjusted for inflation and escalated for their respective dates of obligation.

Warranty: A legally enforceable guarantee of the assurance of the duration or quality of a product or the work performed, usually one year. Speciality items may have a longer warranty period, i.e., roofs, HVAC components, etc.

DIRECTIVE AND OTHER REFERENCES

This listing identifies other directives or procedures that are also pertinent to major facilities construction projects. Copies of these directives, if not available from your AAO can be obtained from FCMD.

1. DIRECTIVE 212.10: ARS construction program appropriation authorities and limitations.

   This Directive defines the various construction programs, authorities and limitations contained in the annual ARS appropriation; defines area and headquarters responsibilities and states policy and procedure regarding those costs chargeable to the limitations.

   Program personnel will approach you from time to time and inquire as to the limitation ceilings for ARS construction. This directive will be of great benefit for this situation. Remember that ceilings are subject to change each fiscal year, so contact your Area Administrative Office or FCMD to verify limitations.

2. DIRECTIVE 212.14: Bid alternates in construction projects.

   This directive provides ARS policy and procedures regarding the use of additive and deductive bid items in construction projects. Process is necessary in order to ensure the buying of a project within the estimated construction cost.

3. DIRECTIVE 212.7: Six-percent limitation - architectural-engineering contracts.

   This directive provides policy on costs chargeable to the statutory limitation of total price paid under contracts for A-E services.

   This policy will provide you with an overall awareness of design services costs versus other services costs that are not chargeable to the mandatory 6% design limitation.

4. CONSTRUCTION PROJECT DESIGN MANUAL: This manual, which is provided to A-E firms doing business with ARS, discusses the Agency's general objectives, considerations, and procedures for technical requirements, such as site planning, geotechnical elements, etc. The manual is primarily an engineering document.

5. FACILITIES CONSTRUCTION HANDBOOK: This handbook is a guide which describes how the Agency conducts facilities construction, other than major.

6. GREENHOUSE DESIGN STANDARD (GDS) MANUAL: A prototype design of several types of greenhouse structures described in terms of greenhouse size, materials, and controls. This design standard allows the user to select a site- and program-specific greenhouse design. Some additional A-E design is needed to supplement the GDS to define foundation requirements, temperature and humidity systems, and specific floor plans.

Exhibits

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Assessment of Facility and Program Needs
U.S. Horticultural Research Laboratory
Orlando, Florida

Florida is a major producing State for citrus and other horticultural crops. The annual farm value of all horticultural crops is conservatively estimated to be $3 billion with citrus being the single most important crop. Florida citrus production is 63 percent of the U.S. total and accounts for 96 percent of all citrus processed. About 6 percent of the U.S. vegetable production is from Florida with 97 percent going to fresh market. Ornamental and florist crops also are important crops in the State.

The U.S. Horticultural Research Laboratory, Orlando, Florida, has the mission to develop and sustain independent and cooperative research programs on citrus and other horticultural crops to serve Florida and other subtropical production areas of the United States. The main office-laboratory building was built in 1952 on 4.5 acres which now is largely surrounded by commercial and residential properties. It is expected that urban encroachment will continue and intensify over the next few years. Such encroachment prevents normal expansion and modification of research facilities and programs and, in some cases, curtailment of certain research activities. The facilities are old, energy intensive, and will require about $5 million over the next 10 years to repair, maintain, and modernize.

Because of problems facing the citrus industry such as citrus canker, tristeza, other exotic diseases, and the lack of registered commodity treatments for export of citrus and citrus products, there are new and increased research activities at the laboratory. To accommodate these changes and special research programs, 24 buildings or structures in addition to the original office-laboratory building are now being used. Thus, there is inadequate space for buildings, field plots, and employee and visitor parking. Space is not available for biological containment and other special research facilities. Current programs can continue under existing conditions but efficiency of research operations is greatly reduced. The laboratory has inadequate acreage and the location is less than desirable for agriculture research. There is the need to expand research programs to meet changing industry needs.

The following information is provided for a comparison of existing facilities and program areas with projected needs.

Facilities	Present Square Feet	Needed Square Feet
Office/laboratory	21,706	72,950
Greenhouse/headhouse	19,539	23,000
Biological containment facility	0	5,500
Other special facilities	1,684	5,300
	42,929	106,750

Professional Staff	Present	Total Projected Need
Geneticist/breeder	3	2
Germplasm curator	1	1
Molecular biologist	1	3
Chemist/biochemist	1	6
Physiologist	4	4
Horticulturist	3	2
Pathologist	3	4
Nematologist	1	1
Entomologist	4	4
Marketing specialist	2	2
Soil scientist	0	1
	23	30

Research Programs

Present - Current programs include research on evaluation of citrus germplasm; variety development; development of genetic engineering techniques; cold hardiness; citrus rootstocks; commodity handling; commodity treatments; shipments to exports markets; integrated pest management systems; biological control; and eradication and/or control of insect, disease, and nematode pests of citrus and other horticultural crops.

Projected needs - The Florida citrus industry is faced with some very serious production and marketing problems which may become even more acute in time. Unseasonal cold weather has caused serious fruit and tree losses in recent years and there is a need for development of new improved cold-tolerant varieties. New genetic engineering and molecular biology techniques are needed to transfer cold-tolerant genes from cold-hardy citrus relatives to commercial citrus types.

Citrus canker has recently been found in Florida and other diseases and pests not now found in Florida are also likely to be accidentally introduced. These include more virulent forms of tristeza virus, greening disease, Mal Secco disorder, sweet orange scab, black spot, citrus ring rot, psorosis disease, stubborn disease, and insect vectors. New research is needed on all of these potential problems as well as methods of eradication or control. A biological containment facility will be required for this research.

The Florida citrus industry faces a potential problem with pesticide residues contaminating the ground water supply. Research on biological control of major pests will help reduce this threat as will development of new varieties with natural pest resistance. However, until such time as biological control measures and new varieties are developed, there is need for more research to monitor the presence and activity of pesticides in field plantings and the fate of pesticides in the soil.

An understanding of the nature and maintenance of quality of citrus and other horticultural crops will continue to be important for both domestic and export

markets. Research is needed on ways to improve product quality as well as ways to better present products to the consuming public. Use of edible wrapper films, other procedures for preparing lightly-processed citrus and other products for market, and non-thermal treatments for preparation of citrus juice are examples of new research areas needed to strengthen U.S. agriculture in world markets.

Land

About 30 acres of land in the citrus belt would be needed for a new office/laboratory building, greenhouses, screenhouses, support buildings, and small field plots.

Estimated Cost of New Consolidated Facility

Planning and design	$ 1,425,000
Construction	14,250,000
Construction phase services	640,000
Construction contingencies	570,000
Specialized research equipment	700,000
	$17,585,000

Prior to the expenditure of any planning/design funds, access to adequate land located in a non-urbanized area will need to be secured through acquisition of an appropriate real property interest such as fee simple ownership or long-term leasehold. If a cost-free transfer, land exchange, or lease cannot be negotiated and no suitable Federal property is available, land acquisition costs will need to be included in the above estimate. Land costs vary depending on the type of property and location. The estimated value of the current site is approximately $15/square foot or $2,940,300.

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United States Department of Agriculture
Agricultural Research Service
Facilities Construction Management Division
6505 Belcrest Road
Hyattsville, Maryland
20782

SUBJECT: Action Plan for the
National Seed Storage Laboratory
Fort Collins, Colorado

TO:
Administrator, ARS

FROM:
Deputy Administrator

In accordance with established procedures, my staff has developed the enclosed Action Plan for your approval.

The Facilities Construction Management Division is responsible for coordinating this effort through the team approach by interacting with the National Program Staff, Program Manager, Program Project Manager, the Architect Engineer, and the contractors.

Should you require additional information concerning the Action Plan, please contact Director, FCMD.

Enclosure

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ACTION PLAN

National Seed Storage Laboratory

Fort Collins, Colorado

1. Introduction: The Facilities Construction Management Division (FCMD) is responsible for the successful accomplishment of this construction project. This Action Plan has been developed by FCMD to describe the project, identify the specific roles and responsibilities during the design and construction of the project, and establish project policy.

2. Project and Nature of Facility: The purpose of this project is to construct all new facilities or to construct new facilities in conjunction with the renovation of existing facilities to provide laboratory, seed storage, and support space in the most cost effective and efficient manner. The first step in the design process will be a study to determine the best way that this can be accomplished within the funds available. The final facility will consist of laboratories and offices, underground seed storage vaults, growth chambers, and library conference facilities. The facility will be constructed on the Colorado State University (CSU) campus with access to the cooperating facilities of CSU.

   The National Seed Storage Laboratory houses the base collection of germplasm for the National Germplasm System. It also houses several base collections of germplasm for the International Plant Germplasm Preservation System under an agreement with the International Board of Plant Genetic Resources. Both collections are expected to continue to increase at a rapid rate for an indefinite period. Because of the need to store a wide variety of kinds of seeds for as long as possible without loss of viability or shifts in genetics composition of the individual accessions, it is essential for the Laboratory to maintain a strong research program.

3. Project Team:

   a. The primary members of the project team are held accountable for the successful and timely execution of the project. The primary members and a brief description of their responsibilities are as follows:

      1) Engineering Project Manager (EPM): The EPM is the project team leader. He/she is an FCMD engineer or architect assigned as the principal representative of ARS interests during planning, design, and construction of the project. He/she provides professional consultation to the project team members and other interested Agency personnel. He/she is responsible for overall project management, including budgetary and schedule development and monitoring. The EPM monitors design, provides project information, coordinates reviews, and signs final design documents. THe EPM may serve as the Contracting Officer's

Representative during construction. He/she makes site visits, coordinates facility inspections, and serves as the principal liaison with the Architect-Engineer, Construction Contractor, Construction Inspection Contractor, and project team members.

2) Program Manager (PM): The AD is usually the PM. The PM has overall project responsibility with appropriate decision making authority (excluding technical engineering, contracting authority and decisions and other administrative decisions). The PM delegates certain operating authorities and responsibilities for the design and construction process but retains final authority for decisions on program and financial issues of the project. The PM, together with the PPM, ensure that the proposed and completed facility satisfies criteria for a usable facility to conduct research and, when applicable, satisfies any special requirements of the Cooperator. The PM is responsible for ensuring compliance with National Environmental Policy Act (NEPA). The PM is the fund holder for the project and is responsible for AD-700 requisition approval and issuance.

3) Program Project Manager (PPM): The PPM is usually the Location Coordinator. The PPM coordinates the project's program requirements to formulate a specific statement of program requirements. He/she serves as the EPM's primary source of information about program criteria and, when applicable, Cooperator criteria, coordinates program review of designs and proposed contract modifications, initials final design documents, and arranges meetings between the EPM and program officials. The PPM is responsible for signing all levels of design submissions. The satisfaction of research program needs is a major objective throughout the design and construction process.

4) Program Project Executive (PPE): The PPE is usually the Associate Administrator, ARS. The PPE has project oversight responsibility, if assigned by the ADMIN. He/she works and consults with the PM, PPM, and others as designated by the ADMIN. He/she works with the proper officials of the Cooperator, when necessary or appropriate. He/she reviews and approves plans that are developed by personnel of the AM in consultation with the PM and PPM. He/she resolves program and financial disagreements or makes final program and financial decisions when appropriate.

5) National Program Staff Representative (NPSR): The NPSR is usually assigned as the principal Agency representative for providing information regarding the project location's current and projected research mission, program increases, and staffing levels.

6) Contracting Officer (CO): The CO is the only member of the Project Team with authorization to obligate Government funds by contract. This authority is delegated by the Agency Head. He/she is an FCMD staff member. The CO assures contracts are in

compliance with regulations and are executed and administered in a fair and equitable environment. He/she is responsible for the business management and coordination of the project from the planning phases through the completion of the project and administrative closeout. The CO monitors performance and budgetary events assuring adequate progression, he/she enforces compliance with contract requirements to protect the Government's interest. He/she conducts conferences, submits report to Congress, makes recommendations regarding reprogramming. The CO is the only one authorized to change contract provisions.

7) Contracting Officer's Representative (COR): The COR is designated and authorized by the CO to monitor performance of A-E contractors and/or construction contractors. His/her duties are outlined in a letter from the CO and may include evaluation of change order requests, recommendations for payment, final inspection, etc. The COR may approve minor changes that do not affect contract price or time. The COR is not authorized to obligate funds, issue time extensions, suspensions of work, terminations or any other action changing the terms of the original contract.

8) General Services Division (GSD) Representatives: Representatives from GSD's Safety and Health Policy Staff Property Management Branch, and Data Administration Branch are responsible for ensuring that the project complies with the criteria and regulations for their respective areas of responsibility.

9) ARS Telecommunications Manager: The ARS Telecommunications Manager (or the designated representative), ADP and Major Equipment Branch, CAD is responsible for ensuring that the project complies with Agency criteria regarding telecommunications.

10) Area Office Engineer (AOE): The AOE is assigned as the technical consultant and resource to the PPM and EPM during the planning, design, and construction of major facilities projects within his/her Area.

11) Architect-Engineer (A-E): The A-E is a private contractor who provides professional services of an architectural, engineering or related nature associated with research, development, design, construction, alteration, or repair of real property and usually required to be performed by a registered or licensed professional architect or engineer. The A-E provides investigative, analytical, design, quality control, project management, inspection, review and consultative services. The A-E may also formally conduct presentations at the various stages of design development and construction, provides complete documentation of all such meetings, informs the EPM of technical problems, provides technical advice and consultation during design and construction, reviews shop drawings, and provides field review services in conjunction with a Construction Inspection Contractor. A separate A-E contractor is also used for Design & Estimate Review Services.

12) Construction Inspection Contractor (CIC): The CIC coordinates construction contract(s) for completion of the construction; inspects work of the contractor(s); coordinates construction with delivery schedules of various equipment manufacturers; coordinates the scheduling and integration of the various phases of construction with the contractor(s), PPM, and EPM/COR; inspects, tests, and approves construction materials and equipment; provides progress reports; resolves minor field situations; approves minor changes that do not affect contract price or time. The CIC is not authorized to obligate funds, issue time extensions, or suspensions of work. The CIC maintains proper contact with the CO, EPM/COR, and A-E. The CIC may be the A-E firm that provided the design.

13) Cooperator: A cooperator is a State or Federal agency or private organization having a mutual interest in agricultural research that has entered into a valid and legal memorandum of understanding, cooperative agreement, long-term lease, or similar document demonstrating that a proposed cooperative effort is of benefit to people of the United States. A cooperator is not always involved in all major construction projects.

4. Policy

a. Congress has approved planning and design funding in the amount of $1 million. However, the Agency will not proceed with design until a lease has been finalized and executed. A construction project budget of $11 million for brick and mortar, fixed equipment, and construction phase services is contemplated.

b. Strict adherence to the project budget will be required. The estimated construction cost will be formulated in accordance with Agency guidelines and will be closely monitored through all phases of project design to prevent a cost overrun situation at the 100 percent design submission.

c. Project team members will have regular communications and periodically meet under the guidance of the EPM to assure the project is properly administered and to expeditiously resolve any problem when identified. The CO will prepare reports on the status of project design and construction for distribution to ARS management and project team members.

RECOMMENDED:

_____ _____

Director, FCMD Date

APPROVED:

_____ _____

Administrator, ARS Date

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER
P.O. BOX 166
CLAY CENTER, NEBRASKA 68933

FUNCTIONAL STATEMENT

INTRODUCTION

EVOLUTION OF PREVENTIVE VETERINARY MEDICINE

Preventive veterinary medicine has evolved over the last one hundred years in four phases of activity.

Phase 1. Over 100 years ago, national and state governments began to get involved in the eradication of diseases such as Texas fever and bovine pleuropneumonia. Some diseases have been eradicated from the U.S. Others are still being pursued. National disease eradication programs have been directed toward control in an animal population in a geographical region. As each regions became free of the disease, only disease-free animals were allowed to enter. Conceptually, by this means a disease could be eradicated from a geographical region. These programs were made possible because reliable diagnostic technology was available, testing was made mandatory by legislation, and financial resources were appropriated from public funds. These activities continued, exemplified by the eradication of hog cholera from the swine population and the present effort to rid cattle of brucellosis.

Phase 2. Starting about the time of World War I, meat, milk, and fiber producing livestock (cattle, sheep and swine) became more available to consumers through increased livestock production, thereby increasing their net worth to the livestock producer. Veterinarians in private practice previously concentrating on equine medicine shifted more attention to livestock (red meat animals or food animal medicine). When livestock became sick it was economically practical to call a veterinarian to treat the individual animals. Antibiotics and other chemotherapeutics became available during this time, and veterinarians could treat a wide variety of infectious diseases with spectacular results. Moreover, immunologic research showed that vaccines could be used to control diseases with similar spectacular results. Veterinarians developed skills in aseptic surgery, e.g., cesarean sections in cows, which became a common procedure in veterinary practice. However, the emphasis was on the individual animal affected by clinical disease and not on the health of the herd. This type of veterinary approach was practiced at MARC until 1982.

Phase 3. Beginning in the mid-1960's, veterinarians and livestock producers came to appreciate the value of taking positive measures to maintain a high level of animal health and efficient production on a herd basis. Livestock producers themselves came to recognize and treat the more common diseases of food animals. Vaccination programs were developed, but usually for a single disease entity. For example, a livestock producer with an outbreak of blackleg in calves would call a veterinarian with the usual recommendation to vaccinate calves in subsequent years. As veterinarians became more involved with the livestock producer and the herd on a regular basis, the presence of subclinical diseases that resulted in poor animal performance were

recognized. Subclinical diseases were identified as the major cause of economic loss in food producing animals. Disease such as infertility and gastrointestinal parasitism responded dramatically and economically to prophylactic treatment.

The recognition that economic benefits could be derived by taking positive action against subclinical disease was followed by programs in planned herd health management. Veterinarians began to become more involved with the daily operation of the livestock producer, either as full-time employees or through contractual agreements. "Preventive veterinary medicine" began to evolve. Livestock producers and veterinarians became aware of the need for keeping good records of animal health and production so that objective analyses of health and production, and their costs could be ascertained. MARC moved into this area when the Preventive Medicine Program and Herd Health Record System were put in place in 1982. Unfortunately, the producer and veterinarian tried to fill their preventive medicine program with every known procedure whether the disease was likely to occur or not, whether the particular measure was highly effective or not, and frequently with more than one effort to prevent one disease. Many programs could, and often did, cost more that the losses they were designed to eliminate.

Phase 4. During the 1980's, veterinarians and livestock producers are taking steps to make regularly scheduled visits to herds. All animals are examined and their records evaluated for evidence of subclinical and metabolic diseases. Information is analyzed with the use of the computer using sophisticated multivariate analyses. Both livestock producer and veterinarian establish performance goals for the herd. Records are regularly evaluated for animal health and production and actual performance compared to the goals. The reasons for the differences are then derived and corrected. This type of program is not easily developed. It requires the input not only of the veterinarian, but also from nutritionists, geneticists, reproductive physiologists, engineers, forage specialists, agronomists, soil scientists, and economists.

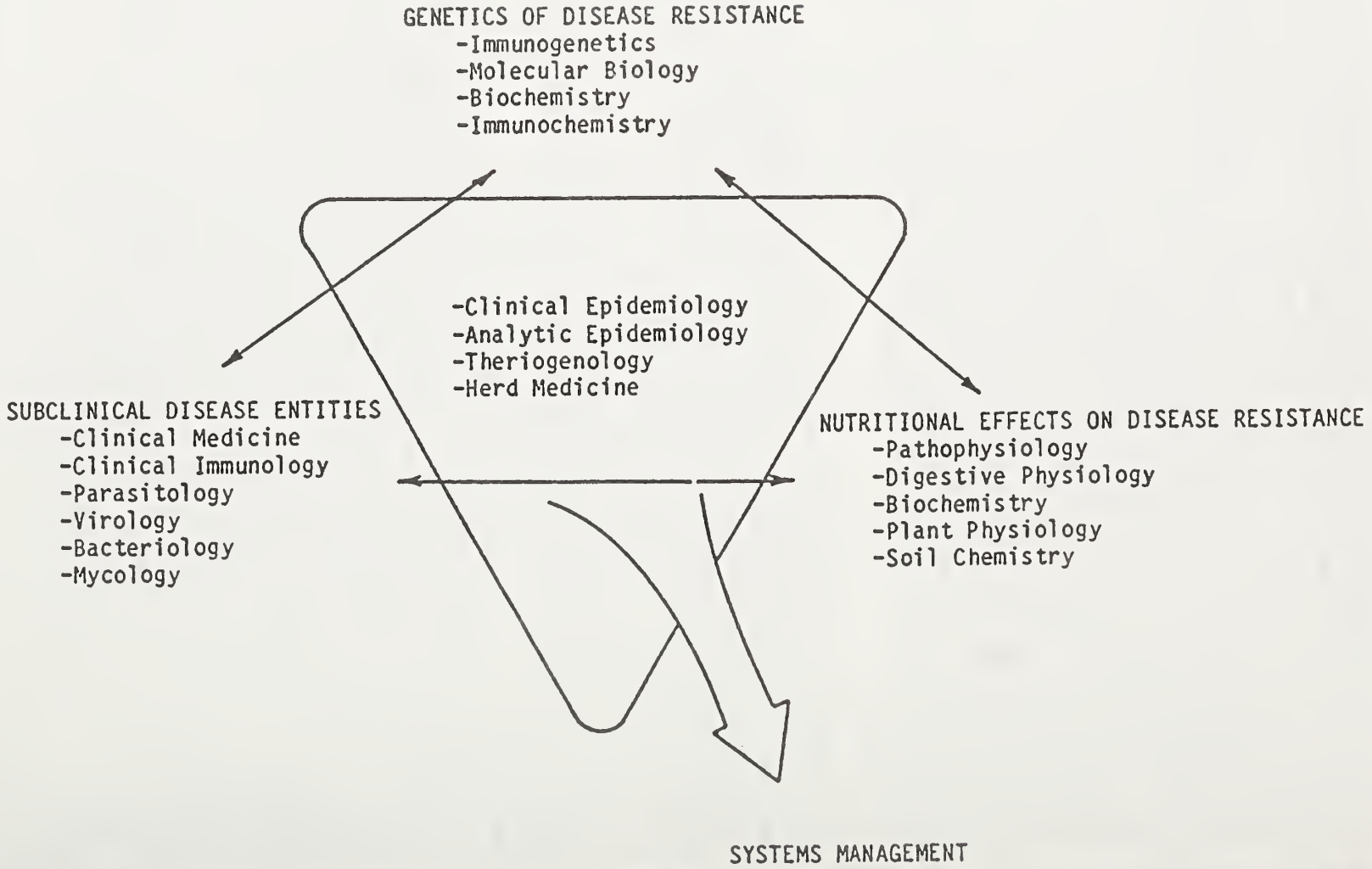
Food animal production inefficiencies resulting from factors that degrade preventive medicine programs can be eliminated if (1) current technology is applied, (2) preventive medicine systems are improved, and (3) new technology is developed through fundamental and applied research. Three important constraints to improved preventive medicine programs are (1) deficiencies in specific diagnostic tests and immunologic approaches for many important infectious diseases of livestock, (2) lack of methodology to interpret causal relationships of the multiple etiological factors responsible for production diseases and strategies for the control of these diseases under farm and ranch conditions, and (3) lack of adequate systems for the definitive diagnosis and recording of livestock diseases and means of collecting and managing animal health data. Therefore, it is imperative that ARS develop integrated food animal health systems which are interdisciplinary and multifactorial; that they identify and quantify factors, and their multiple interactions responsible for losses and inefficiencies in livestock production; and document the economic ramifications. Moreover, they need to develop analytical systems to construct practical strategies for the control of production diseases, examine causative interactions to substantiate assessment of control strategies, and develop simulation models to evaluate alternative control strategies.

Despite the fact the U.S. livestock industry, including MARC, has been successful in controlling many serious epidemic infectious diseases, losses to productivity from other livestock diseases are still high. The majority of these losses are caused by production diseases. As a class, they are complex epidemiologically and involve infectious, genetic, metabolic, nutritional and chemical etiologies and combinations of several acting in concert with environmental, social, and management factors. Among the more important production diseases are: (1) infectious complexes, e.g. mastitis, neonatal scours, multiple gastrointestinal parasitisms; (2) reproductive disorders, e.g. low fecundity, weak calf syndrome, abortion storms; (3) stress related syndromes, e.g. bovine respiratory disease complex, salmonellosis, transport tetany; (4) metabolic disequalibria, e.g. ketosis, hypomagnesemic tetany, immune failure; (5) digestive system disorders, e.g. bloat, lactic acidosis, malabsorption syndromes; (6) nutritional disorders and marginal malnutrition/infectious disease complexes exacerbated by deficiencies in minerals and other micronutrients, e.g. grass tetany, immuncompetence; (7) toxicosis induced by industrial and agricultural chemicals and wastes, poisonous plants, and mycotoxins; (8) infestations with ticks, fleas, lice, and biting diptera; and (9) a multiplicity of interactions between two or more of the above.

Some production diseases cause a large number of deaths while others may produce high rates of clinical illness in affected herds. However, for the most part, production diseases cause their greatest impact on the productivity of livestock enterprises with little clinical sign of disease. These insidious disease complexes drain productivity and, thereby, the profit margin. A great deal of knowledge exists for some of the important production diseases, but surprisingly little for others.

To address these issues, ARS created the Animal Health Systems Research Unit in 1984 to develop research programs that would lead to effective preventive medicine programs or animal health systems. MARC is uniquely qualified to attack many of the production diseases mentioned above. With the large animal base (numbers and genetic diversity) of cattle, sheep and swine, multiple disciplinary research teams can be assembled using scientists from the AHSRU and the other six research units. Moreover, through collaborative research with other ARS laboratories, NADC, API, ABADRL, Lincoln and Kerrville; and state land grant universities, especially UNL and KSU, scientific expertise can be assembled to address virtually any production disease problem--if sufficient funds are available. Figure 1 presents a conceptual diagram of an approach to studying production diseases. Interdisciplinary areas of research, i.e. genetics of disease resistance, nutritional effects on disease resistance, and subclinical disease entities are shown on the triangle sides with the scientific disciplines to be addressed in each. Arrows show that interaction and exchange of information must flow between. Finally, the disciplines in the center of the triangle synthesize the information from the research areas. Information synthesized into systems models is transferred to production systems management. All disciplines shown in Figure 1 will not be in the Animal Health Systems Research Unit but are available within the cooperative associations mentioned above.

Figure 1. Schematic representation of an approach to research of production diseases.



PROGRAM OF REQUIREMENTS

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY

CLAY CENTER, NEBRASKA

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OVERVIEW OF CENTER:

The U.S. Meat Animal Research Center (MARC) was authorized by Congress on June 16, 1964, thereby creating a single facility that provides an unusual opportunity for making major contributions to the solution of problems facing the U.S. livestock industry. Development of the 35,000-acre facility started in the spring of 1966 and is continuing at the present time. Phase I construction, consisting of an office-laboratory building for intensive investigations, was completed in January 1971. These facilities provide a physical plant for 42 scientists and about 200 support personnel. Phase II construction, consisting of the Meats Research Laboratory and Agricultural Engineering Building, was completed in October 1977 and provides a physical plant for 25 scientists and about 60 support personnel.

Approximately 50 percent of the research program is devoted to beef cattle, 30 percent to swine, and 20 percent to sheep. Current research program objectives require breeding-age female populations of approximately 7,000 cattle (17 breeds), 4,000 sheep (8 breeds), and 550 swine litters (8 breeds) per year. These are maintained as closed herds.

The research program at the Center is organized on a multidisciplinary basis and is directed toward providing new technology for the U.S. livestock industry by extending investigations into new areas not now being adequately studied. The research program complements research conducted elsewhere by the U.S. Department of Agriculture and is cooperative with the Nebraska Agricultural Experiment Station and other land grant university agricultural experiment stations throughout the country.

On October 10, 1978, the President signed into law a bill renaming the U.S. Meat Animal Research Center the Roman L. Hruska U.S. Meat Animal Research Center. The purpose of the bill was to honor former Nebraska Senator Roman L. Hruska for "his efforts in the establishment of a centralized Federal facility for the research, development, and study of meat animal production in the United States."

HISTORICAL BACKGROUND FOR VETERINARY RESEARCH AT MARC

In 1959, the U.S. Department of Navy announced its intent to dispose of the munitions depot headquartered at Hastings, Nebraska. Some scientists and administrators of the former Animal Science Research Division of ARS, Beltsville, Maryland, conceived the idea of establishing a center for research on red meat animal production. The ARS Administrator gave his approval to plan this facility in 1963. In the early stages of planning, a need was recognized for a research program that would bridge the existing gap between animal production and animal protection research within ARS. This is best stated in the Report of Meeting, Advisory Committee for the U.S. Meat Animal Research Center, Clay Center, Nebraska, October 29-31, 1975:

> "The U.S. Meat Animal Research Center plans to develop a research effort relating to Herd Health and Disease Management. In addition to specific research efforts, this Unit would provide herd health services for the experimental populations of cattle, sheep, and swine. It is anticipated that the herd health program will provide the primary basis for problem identification and definition relating to the research program of this Unit. It is planned that the research program of this Unit would focus on

production-disease interaction considerations with the objective of filling the void that exists between production and protection research as a basis for providing for a more comprehensive meat animal research program. The efforts of this Research Unit would be highly collaborative with the production oriented research efforts at the U.S. Meat Animal Research Center and with the disease oriented research efforts at the National Animal Disease Center. A primary objective would be to incorporate effective programs of herd health and disease management into beef cattle, sheep, and swine production systems. Also, there would be a need for collaboration with other appropriate research efforts of ARS and State Agricultural Experiment Stations relating to parasitology and entomology.

The basis for planning a Herd Health and Disease Management Research Unit is to "bridge the gap" between production and protection oriented research efforts in order to provide a more comprehensive meat animal research program. It is well documented that herd health and disease management factors interact with nutrition and other aspects of the production environment. Thus, the rationale for this program which would involve the efforts of four to five scientists.

The research program of this Unit would focus on problems that cannot be pursued by either the National Animal Disease Center or other programs oriented toward protection research; and the U.S. Meat Animal Research Center (as presently organized), or other programs oriented toward production research. The idea is to pursue problems in the "no man's land" that now exists at the interface between specific protection and production oriented research efforts. Such a Research Unit should provide a vehicle for viable collaborative efforts between the National Animal Disease Center and other protection oriented research programs and the primary research program areas on meat animal production at the U.S. Meat Animal Research Center.

The research program of this Unit would give attention to the eye problems, respiratory problems, metabolic disorders, enteric problems, foot problems, etc."

Establishment of a Herd Health and Disease Management Research Unit was pursued and a Congressional Appropriation of $78,900 was obtained in FY1977. Planning and recruitment of a Research Leader for the new Unit followed. However, it was not until FY1984 that this goal was achieved. In the interim, the FY1977 funds were used to support a federal clinician. In the process of reducing administrative costs, ARS management redirected $196,000 to MARC to establish the research unit, renamed the Animal Health Systems Research Unit, and a person to coordinate the Unit's activities.

During this process, the National Cattlemen's Association and the National Pork Producers Council, as well as many other industry groups, have given strong support to develop this program in applied veterinary disease research. Earliest written records of this support were their testimonies before the Agriculture Appropriations Committee of the U.S. Congress in March 1982. Support has continued each year since. This culminated in an FY1986 appropriation of $4 million to construct and equip a research facility and $135,000 to recruit an additional scientist in the Unit.

PROGRAM OF THE ANIMAL HEALTH SYSTEMS RESEARCH UNIT

MISSION:

The Animal Health Systems Research Unit of the Roman L. Hruska U.S. Meat Animal Research Center has a two-fold mission of research and service. The research aspect focuses on developing integrated programs for control of diseases and parasites which cause losses in beef cattle, swine, and sheep production enterprises. Companion research programs at the Center (reproduction, genetics, nutrition, meats, production systems, and environmental stress) provide a unique opportunity for collaborative multidisciplinary research approaches utilizing large herds of animals under highly controlled experimental conditions. Animal health research, for the most part, is super-imposed as appropriate on existing research programs through cooperative development of experimental protocols, thus enhancing the overall use of the Center's resources.

Animal health systems research comprises research programs designed to apply and evaluate the knowledge gained on control of etiological agents in large populations exposed to natural infection. This research is an integrated approach to multivariate, systems evaluation of numerous disease syndromes and other deterrents to optimizing food production from livestock. Research will be problem driven rather than technology driven.

The service component of the Unit will focus on maintenance and improvement of recordkeeping in preventive veterinary medical practices, and animal care and safety for beef cattle and sheep on pasture, in confinement, and in the feedlot; and for the SPF swine herd. This function is an integral part of the research program because it gathers the majority of the data through records obtained on disease surveillance of infectious and non-infectious disease syndromes in the herds. Likewise, results of the research will feedback to an improved preventive medicine program.

OBJECTIVES:

1. Develop surveillance methodology to determine the incidence of clinical and subclinical diseases, parasites, and arthropods in controlled herds with special emphasis on bluetongue, respiratory disease complex, diarrheal disease complex, and pinkeye.

2. Determine genetic differences in the immune response of individuals and breeds to infectious agents, and develop new knowledge about bovine immunology.

3. Determine the influence of infectious agents on reproductive failure in cattle including neontal losses.

4. Evaluate preventive medicine practices for control of production diseases and determine the economic parameters.

5. Develop preventive medicine programs using research generated at MARC and from other ARS research units with economic evaluation of the parameters.

6. Develop simulation models of preventive medicine programs for application to production systems models.

RELATION OF PROGRAM TO OTHER USDA LABORATORIES

The program of the Animal Health Systems Research Unit is unique in ARS, but must be closely coordinated with other related research programs, specifically those at the National Animal Disease Center at Ames, Arthropod-Borne Animal Diseases Research Laboratory at Laramie, Animal Parasitology Institute at Beltsville, Midwest Livestock Insects Unit at Lincoln, and U.S. Livestock Insects Laboratory at Kerrville; and the programs in the Department of Veterinary Science, University of Nebraska, Lincoln and College of Veterinary Medicine, Kansas State University, Manhattan. Additional cooperative research may be developed with the other departments, schools, and colleges of veterinary science in the U.S.

RELATIONSHIP TO ARS STRATEGIC PLAN

The ARS Program Plan of 1983 identifies five challenges to agriculture that must be addressed by ARS if the Agency is to address the long-term ability of the U.S. to sustain agricultural productivity. These challenges are:

1. The U.S. has become the residual supplier of agricultural commodities for a growing world population. In 1981, crops harvested from nearly 40 percent of all U.S. acreage and valued at about $44 million were destined for foreign markets. World food production must double in the next 40 years to meet projected demands.

2. Our base of natural resources has declined in quantity and quality because groundwater supplies have diminished, farmlands and irrigation water have been lost to other uses, and excessive erosion of top soil continues from about a third of our farmlands. Additional land and water supplies can be developed, but their costs will be higher and their productivity lower than for those now in use.

3. The productivity of key components of agriculture is beginning to peak or flatten out. Average farm yields of crops such as cotton, rice, sugarcane, and dry edible benas have not increased in many years, and yields of other crops may also be peaking. The productivity of farmers' inputs actually declined 7 percent during the 1970's. That trend is continuing into the 1980's; farmers' costs for inputs are increasing and the productivity of the inputs is generally decreasing.

4. We face an increasing number of new constraints that include high costs of petroleum and natural gas and of products, such as fertilizer, that are derived from them; increasingly erratic weather patterns in the past decade; only fair to poor condition of about 60 percent of our rangelands; increasing regulation of agricultural chemicals and processes; and many actual or potential environmental constraints, such as air pollution and declining water quality.

5. Improving the economic health of agriculture and of its independent entrepreneurs is a major challenge. To adopt new technologies and to meet the anticipated needs of future generations, agricultural business must be economically strong.

THE STRATEGIES ARS WILL EMPLOY ARE:

1. Maintain emphasis on mission-oriented, fundamental, long-range, and high-risk research.

2. Increase emphasis on integrative systems research.

3. Emphasize research approaches directed toward increasing efficiency of operation and quality of production reducing the use of non-renewable resources and increasing the dollar value of agricultural products.

The program of the Animal Health Systems Research Unit will directly address challenges 1 and 5 above. Its research programs will employ all the strategies. The mission and objectives specify that the work will be mission oriented, fundamental in part, and that an interactive systems approach will be taken to develop rational preventive veterinary medicine programs. By developing these programs, the research will lead to an increased efficiency of operation and quality of production.

Research planned for the Animal Health Systems Research Unit is expected to address the following elements of the ARS Program Plan.

Objective 3: Develop the means for increasing the productivity of animals and the quality of animal products.

1. 3.1.03.1.a - Inability to identify biochemically in animals the genes and gene products that confer resistance to disease organisms and to the effects of parasites limits development of genetically resistant animals.

2. 3.4.02.1.a - Incomplete understanding of the effects of environmental factors, genetic makeup, and endocrine function on animal health reduces the ability to produce healthy livestock.

3. 3.4.02.1.b - Information on the effects of stress on the immune systems of animals is inadequate for maintaining livestock that can resist or recover from disease.

4. 3.4.02.1.c - Knowledge of the interaction of nutrition, environment, and management practices on animal health is not adequate for preventing adverse effects of one practice on another.

5. 3.4.02.1.d - Deficiencies in systems concepts have hindered the development and application of microelectronic sensors and controls to health management practices in production environments.

6. 3.4.04.1.a - Information on the economic impact of animal diseases and parasites, both domestic and foreign, is inadequate for setting research, control, and management priorities.

7. 3.5.01.1.b - Inability to estimate within narrow limits population densities and trends for pests and disease vectors prevents application of control measures with greatest efficiency at lowest cost.

8. 3.5.04.1.a - Inability to organize controls for different pests of range cattle under different conditions into integrated systems limits the efficiency and effectiveness with which producers control pests.

9. 3.5.04.1.b - Inability to organize controls for different pests of confined livestock under different conditions into integrated systems limits the effectiveness and efficiency with which producers control pests.

10. 3.6.02.1.a - Lack of information on the interrelationship of the factors necessary for optimum animal reproduction prevents the development of efficient integrated reproduction management systems.

11. 3.6.02.1.c - Lack of complete system models precludes development of management systems that optimize use of resources under various environmental conditions.

Objective 6: Develop the means for integrating scientific knowledge of agricultural production, processing, and marketing into systems that optimize resource management and facilitate transfer of technology to users.

1. 6.1.01.1.g - Improved models and farming systems that optimize farm income and resource conservation strategies are needed for pasture and rangeland.

At present all research is conducted under Strategic Plan Code 3.4.04.1.a.

SCIENTIFIC STAFF

1. Coordinator, Animal Health Systems Research Unit -- Overall management of research programs and research in parasitology.

2. Immunochemist -- Immune mechanisms of genetic resistance to disease. Totally integrated with the Genetics and Breeding Research Unit's program. Also involved in basic studies on bovine immunology.

3. VMO Clinical Immunologist -- Virologic and immunologic mechanisms of production diseases. Partially integrated with the Genetics and Breeding Research Unit's program and partially on implementation of preventive medicine programs and studies of bovine immunology.

4. VMO Epidemiologist -- Epidemiologic evaluation of production disease problems at MARC and develop mathematical models of disease systems.

5. VMO Pathophysiologist -- Working closely with the Microbiologist, Epidemiologist, UNL-Clinical Nutritionist, and the Nutrition Research Unit to determine the complex interactions of disease agents, vaccinations, micronutrients, and production parameters involved in disease susceptibility and resistance.

6. VMO Microbiologist -- Working closely with the Clinical Immunologist, Epidemiologist, Pathophysiologist, and Parasitologist, to determine the involvement of microorganisms in production diseases.

7. Entomologist (Category III) -- Interact with other scientists on the vectors of disease and support cooperative programs with the U.S. Livestock Insects Research Center and UNL.

8. Postdoctoral Scientists -- Two postdoctoral scientists are anticipated to support the research program.

9. Visiting Scientists -- Two visiting scientists are anticipated to associate themselves with the research of the Animal Health Systems Research Unit.

10. The University of Nebraska will have a 2.5 SY component in cooperative research with MARC scientists and will utilize the research facility. They will be: (a) clinical epidemiologist, (b) clinical nutritionist, (c) theriogenologist, and (d) clinical pathologist.

SUPPORT STAFF

The support staff for the Animal Health Systems Research Laboratory will include:

1. Secretary -- Provide secretarial support to the Coordinator and scientists of the Animal Health Systems Research Unit.

2. Clerk Typist -- Support the secretary and act as receptionist for the facility.

3. Research Technicians -- Each scientist will have a research technician in support of the research activities (6). An additional technician will function in glassware maintenance and media preparation (1). Total of 7.

4. Graduate Students -- Four graduate students are anticipated to support the research project.

SPECIALIZED EQUIPMENT

(See table attached.)

Equipment Matrix for Animal Health Systems Research Laboratory

Item of Equipment	Immun Suite	Micro Suite	Parasit Suite	Biochem Suite	Epid Workrm	Glass/ Media	Shower/ Locker	Empl Lounge	Equip Room	Dark Room	Total
CO2 Incubator	4	4		2							10
BacT Incubator	2	4	2								8
BOD Incubator	2	2	2	2							8
Egg Incubator		2									2
Roller Apparatus Incubator		1									1
Refrigerator 4C	2	2	2	2							8
Explosion Proof	1	1	1	1							4
Lypholizer		1									1
Liquid Scintillator				1							1
High-speed Refer Centrifuge	1	1	1	1							4
Low-speed Refer Centrifuge	2	2	2	2							8
Ultra-low Temp Freezers -76C									4		4
Low Temp Freezers -10C									4		4
LN2 Freezers									2		2
Phase/Flour/Photo Microscope	1		1								2
Spectrophotometer Vis/Flour/UV		1		1							2
Analytic Balance & Table	1			1							2
pH Meter	1	1	1	1							4
Technicon Autoanalyzer				1							1
Bio-Safety/Radiol Cabinet 6ft	2	2	2	2							8
Chemical Hood 4ft	2	2	2	2							8
10 gal Chem-Storage Cabinet	1	1	1	1		1					5
Steam Autoclave						1					1
Carboxyclave						1					1
Clothes Washer						1					1
Clothes Dryer						1					1
Laboratory Dishwasher						1					1
Glassware Dryer						1					1
Drying Oven						1					1
Glassware Cabinets						1					1
Computer Terminal	1	1	1	1	2						6
Microcomputer	1	1	1	1	2						6

OFFICE LABORATORY AND GENERAL SPACE REQUIREMENTS

Office and Work Space	Square Feet
Coordinator's Office	300
Secretary's Office	150
Receptionist/Typist Office	300
Scientists' Offices (8 x 150)	1,200
Technicians' Office (3 x 200)	450
Graduate Student Offices (2 x 150)	300
Epidemiology Work Rooms (2 x 200)	400
Computer Room	300
Conference Room	500
Subtotal	3,900
Laboratory Space	
Parasitology Suite	1,760
Immunology Suite	1,760
Microbiology Suite	1,760
Pathophysiology Suite	1,760
Equipment Room	400
Instrument Room	150
Glassware/Media Preparation	400
Dark Room	100
Dry Chemical Storage Room	150
Chemical Transfer Room	50
Subtotal	8,290
General Space	
Shower/Locker/Restrooms (2 x 200)	400
Employee Lounge	400
Subtotal	800
Total	12,190

DESIGN CRITERIA

SITE - The general location of the site selected for the Animal Health Systems Research Laboratory is shown on the attached map of Clay County and the Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, Nebraska. The specific site location for the proposed facility is shown on the attached Site Plan. The size of the proposed site is approximately 15,000 square feet. Climate and weather conditions for the selected site are attached.

ARCHITECTURAL - The Animal Health Systems Research Laboratory shall be designed as a functional facility which is aesthetically pleasing and economical to build and operate. A sound functional plan is the single most important factor in obtaining an acceptable solution to the requirements of the proposed facility. This can and will be achieved through a careful study of the space relationships and a thorough understanding of the needs of the users as expressed herein and in subsequent meetings and discussions. The exterior design of the facility is expected to be compatible with neighboring buildings and to be harmonic with the MARC architecture as a whole.

Consideration should be given to the use of maintenance-free materials, equipment, and building elements. An Environmental Assessment will be prepared in accordance with the National Environmental Policy Act of 1969 (PL 91-110), as amended; Council on Environmental Quality Guideline 40 CFR 1500-1508, and applicable Federal, State, and local regulations. Specifications relating to safety and health in the Occupational Safety and Health Administration regulations, National Fire Protection Association codes, Environmental Protection Agency regulations, Agricultural Research Service safety and health policy, and local building and fire codes must be met as a minimum. The most stringent requirements will be met. Building entries shall be accessible by the physically handicapped as outlined in the American National Standards Institute, Inc. accessibility standard. Types and numbers of equipment are contained in Space Data Sheets.

Codes:

a. Planning provisions shall be made to conform to requirements of Public Law 90-480 (ANSI 117.1) regarding building access and use for physically handicapped personnel.

b. Architects and engineers in performing professional services shall conform to the building code provisions as follows:

Uniform Building Code, latest edition
Uniform Mechanical Code, latest edition
Uniform Fire Code, latest edition
Uniform Plumbing Code, latest edition
Uniform Building Code Standards (adopted by and referenced in the UBC)
National Electrical Code (NFPA publication including bulletins, and Life Safety Code)

c. All applicable codes of the State of Nebraska will be adhered to.

STRUCTURAL - The structural system for this facility will satisfy functional and architectural requirements of the finished structure at a minimum cost. Consideration will be given to maintenance costs. Preferred systems will use material efficiently, provide maximum usable space, minimize use of special equipment, and can be constructed by following conventional procedures. The selection of the best structural system for the facility is an inherent requirement of the design and is inseparable from the functional and other architectural requirements of the facility. Coordination of the structural system with the other systems of the facility should be a continuous process from design through completion of the construction.

MECHANICAL - The design of the heating, ventilating, and air conditioning systems (HVAC) should consider the simplicity of operation, minimization of automatic controls, and the functional flexibility of the systems to meet future expansions. Systems should be designed so that changes can be accomplished efficiently within the overall system concept, without relocation of or alterations to equipment which are not changed. Attached Space Data Sheets contain HVAC and internal utility requirements (air, gas, vacuum, and distilled and domestic water).

ELECTRICAL - Design and installation of interior lighting, electric power facilities, and outside lighting systems should conform, as far as practical, with adjoining community regulations and standards. Primary service is 4160 volt, 3 Ø, 60 cycle, wye. Secondary service will be 208Y/120 volt or 480V/277 volt, 3 Ø, 60 cycle, 4 wire service. Illumination requirements are outlined in the Space Data Sheets. Requirements for emergency power will be kept to a minimum consistent with safety and health requirements. An economic analysis of power sources to determine the optimum scheme will be performed by the architect-engineer, and a short circuit and coordination study for three phase and single phase to ground faults shall be made to select properly rated equipment and protective devices for the fault currents available. Conduit will be installed for telephone communication systems. Layout and conduit size requirements will be coordinated with Lincoln Telephone Company engineers.

SAFETY - a) Planning provisions shall be made to conform to requirements for safety defined in the Occupational Safety and Health Administration and as further defined in the Administrative Memorandum Series 450, Safety and Health of the ARS. b) No biological safety measures beyond the Biological Safety Cabinets need be made.

OUTSIDE UTILITIES - Domestic water will require drilling a new well. Normal pressure for domestic water is 75 psi. Sanitary sewer lines of the facility will require a new sewer lagoon. Natural gas will be furnished from an existing gas line. MARC will provide valve tap. Facility will extend from the valve to building. Normal pressure for natural gas is 15 psi. Electrical service to building will require new line from substation. This facility will provide three single phase, oil filled transformers in a transclosure. The University will furnish and install primary cable and make connections to primary side of transformer. Primary service to building will be 4160 volt, 3 phase, 60 cycle, wye. Storm drainage will be connected to an existing storm sewer line. Facility will extend from, not include, the connecting storm drainage manhole. The Animal Health Systems Research Laboratory will provide and supply, as required, compressed air, vacuum and distilled water within the facility.

PARKING/ROADS - The facility requirement for parking is 20 spaces plus what is removed. Paved access will be required to Shipping and Receiving - Special Purpose Area, Shop Area, and waste disposal system.

ELEVATORS - No elevators are anticipated.

ENERGY CONSERVATION - Integrated economic analysis, comparing fuel and energy sources, is required for heating, ventilating, air conditioning, and refrigerating systems in this facility. Alternative energy sources must be considered.

LANDSCAPING - Minimum sidewalk width is 8 feet. Sidewalks, terraces or patios should be designed to support snow removal equipment. At base of buildings, a "no-mow" gravel strip contained by metal or similar edging will be provided. Existing plants and trees will be preserved and protected, if possible. The landscape design shall be an integral component of the total project environment and should respect and preserve the existing natural attributes. The use of native plants that will thrive in the climate hardiness zone of the facility site is mandatory.

SPECIAL SYSTEMS - Requirements for special systems are contained in the Space Data Sheets.

TASK DESCRIPTION - The project will cover the following items:

Item		Design by A-E	Design by USDA
1.	Comprehensive site development plan	X	
2.	Site survey		X
3.	Soil explorations	X	
4.	Review soil analysis report and evaluation	X	
5.	Building: Laboratory-office, utilities, services	X	
6.	Entrance and service roads	X	
7.	Visitor and employee parking	X	
8.	Walks, curbs, etc.	X	
9.	Grading, top soil, and seeding or sodding	X	
10.	Landscaping plantings	X	
11.	Irrigation system	X	
12.	Utility extensions and connections within property or construction lines	X	
13.	Signs:		
	a. On building	X[1]	X
	b. At entrance road	X	X
14.	Operating Maintenance Manual	X	
15.	Operation and maintenance plan	X	

[1]Signage should be coordinated, if not designed, by the A-E.

Items 1-13 must be coordinated between the USDA A-E and the UNL A-E.

FUNCTIONAL AREAS

The staff functions will incorporate many technics related to the scientific expertise as follows:

Parasitology employs phase, fluorescent, and light microscopy; serology; monometry; counting apparatus; and histopathologic technology.

Immunology utilizes the various serologic technics of agar gel immuno-precipitation (AGID), polyacrylamide gel electrophoresis (PAGE), fluorescent antibody technics (FAR & IFAT), complement fixation (CF), hemagglutination (HA), serum neutralization (SN); and immunologic technics of radioimmuno-assay (RIA), enzyme-linked immunoabsorbed-assay (ELISA), cell mediated immunity (CMI), immunoelectron microscopy, and cell culture.

Microbiology incorporates tissue and cell cultures, egg embryos, and bacteriologic/microbiologic culture systems, as well as the serologic, immunologic, biochemical and physiochemical methodologies.

Pathophysiology also uses many of the above, but primarily biochemical and physiological technics to research pathologic entities.

All laboratories make use of various models of centrifuges, refrigerators, and freezers for storage of blood, serum, plasma, microbial isolates, tissue and cell culture lines, and biological chemicals.

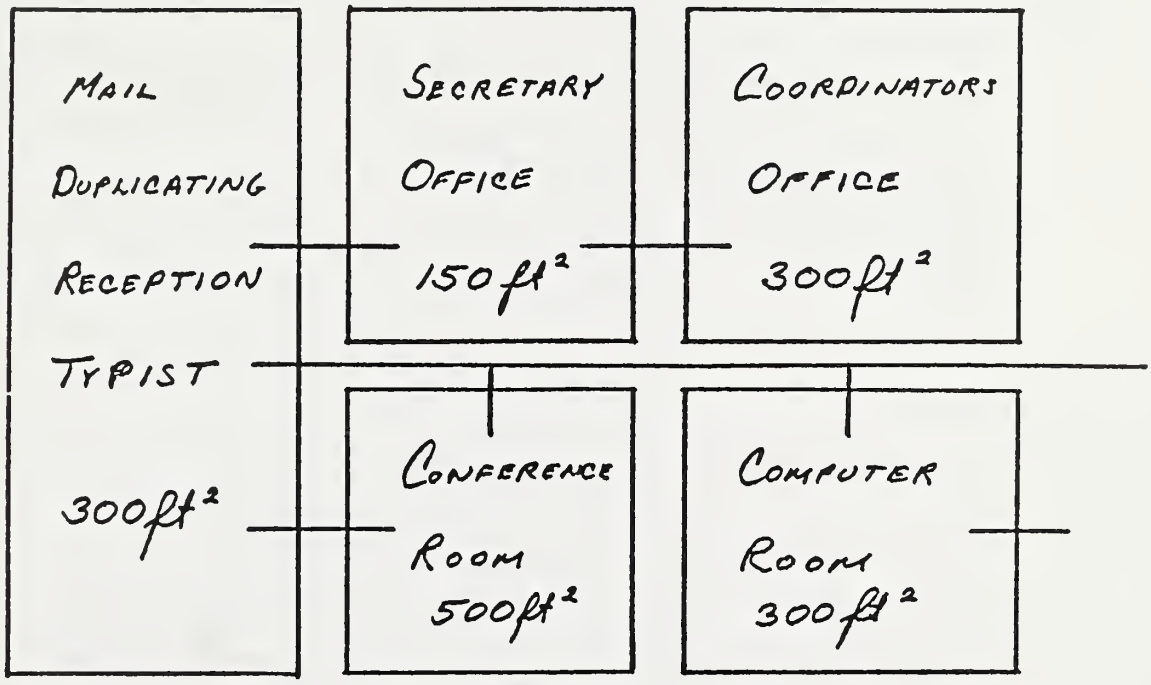
CLIMATE AND WEATHER CONDITIONS

(In the process of accumulating the summary data.)

SPACE REQUIREMENTS

I. RECEPTION/COORDINATOR'S COMPLEX

Coordinator's Office	300	square feet
Coordinator's Secretary Office	150	" "
Receptionist/Typist Office	300	" "
Computer Room	300	" "
Conference Room	500	" "
Total	1,500	" "



RECEPTION/COORDINATOR'S COMPLEX

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Coordinator of the Animal Health Systems Research Laboratory (office space).
REQUIREMENTS	
Number Required:	1
Number of Occupants:	1
Net Area:	300 sq. ft.
Hours of Use:	10 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Paneling
Ceiling:	Acoustic or Drywall
Special Features:	None
ACTIVITY FUNCTION	This space will serve as an office and small conference area for coordinator. The space will accommodate group discussions of 5-6 people.
RELATIONSHIPS	Primary relationship to main entry and connected to coordinator's secretary office.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None
Electrical:	Provide fluorescent lighting; 50-60 footcandles maintained at desk level. Provide 120 volt duplex convenience outlets. Provide one clock outlet.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Communications:	Two telephone outlets. Wired to central computer.

EQUIPMENT

Fixed:	Coat hooks on wall, 4' high x 6' wide chalkboard, 4' high x 6' wide tackboard, and 12' x 8' bookcase.
Movable:	Table for 5-6 people with upholstered chairs, large desk and chair, credenza, and file cabinets.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Coordinator's Secretary (office space).
REQUIREMENTS	
Number Required:	1
Number of Occupants:	1
Net Area:	150 sq. ft.
Hours of Use:	8 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Paneling
Ceiling:	Acoustic or Drywall
Special Features:	Minimize sound transmission through walls.
ACTIVITY FUNCTION	This area will serve as an office for the Coordinator's secretary and secretary for the research unit.
RELATIONSHIPS	This space should be adjacent and connected to the Coordinator's office.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None
Electrical:	Provide fluorescent lighting; 50-60 footcandles maintained at desk level. Provide 120 volt duplex convenience outlets.
Communications:	Two telephone outlets; wired to central computer.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

EQUIPMENT

Fixed:	Coat rack or coat hooks, one 3' high x 5' wide tackboard.
Movable:	Secretarial desk with typing platform, files, and chairs; word processor.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Receptionist/Typist (office space).
REQUIREMENTS	
Number Required:	1
Number of Occupants:	2
Net Area:	300 sq. ft.
Hours of Use:	8 hours/day -- 5 days/week
Access:	Visitors, general
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Paneling
Ceiling:	Acoustic or Drywall
Special Features:	Entrance through glass door. Adjacent to door a 5' high x 6' wide glass window from ceiling measured downward. Minimize sound transmission through walls.
ACTIVITY FUNCTION	Within this space, visitors can obtain information and wait until a host can arrive. The receptionist will function as the primary contact for visitors and provide clerical support to the Coordinator's secretary. Area also will contain the duplicating, mail handling, and workspace equipment for the Unit.
RELATIONSHIPS	Primary relationships to the lobby and Coordinator's secretary.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SYSTEMS

HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None
Communications:	Two telephone outlets; wired to central computer.
Electrical:	Provide fluorescent lighting; 50-60 footcandles maintained at desk level and in waiting area.

EQUIPMENT

Fixed:	Coat rack with hangers, reception counter desk, one 3' high x 5' wide tackboard.
Movable:	Seating arrangement for 5-6 people, typing platform, files, chairs, duplicating machine, and large work table.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Computer Room
REQUIREMENTS	
Number Required:	1
Number of Occupants:	3-6
Net Area:	300 sq. ft.
Hours of Use:	12 hours/day - 5 days/week
Access:	Scientists, technicians and graduate students
CONSTRUCTION	
Floor:	Carpet
Base:	
Walls:	Drywall, Painted. Windowless area.
Ceiling:	Acoustic
Special Features:	Temperature and humidity control according to manufacturer's requirements.
ACTIVITY FUNCTION	This room houses "silent" printing terminal and more sophisticated graphics capability-type terminals than are located in each office.
RELATIONSHIPS	Located in Coordinator's complex.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None
Electrical:	Provide 110/208 volt outlets as required for specialized equipment. Provide fluorescent lighting, 60-70 footcandles maintained at desk level.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Communications:	One telephone line; 4 computer terminals; printer cables connected to rooms with computer terminals.

EQUIPMENT

Fixed:	None
Movable:	Graphics workstations-color; graphics plotter-color; digitizer-large bed; 4 terminals; 300 lpm serial printer.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Conference Room
REQUIREMENTS	
Number Required:	1
Number of Occupants:	20-25
Net Area:	500 sq. ft.
Hours of Use:	10 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Paneling
Ceiling:	Acoustic
Special Features:	Design to minimize sound transmission to adjacent areas, especially Coordinator's office and scientists' offices. Electronic control of lights, screen, and projector. Preferably no windows, or good drape system for darkening room.
ACTIVITY FUNCTION	This space should function as a conference room, with modular tables to permit round-table, face-forward or auditorium seating arrangement. Storage for chairs and tables should be provided.
RELATIONSHIPS	Primary relationships to Coordinator's complex, near lobby area, past receptionist's office.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SYSTEMS

HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	Provide hot and cold water to small sink area.
Electrical:	Provide ample 120 volt duplex convenience outlets. Provide fluorescent lighting, 50-60 footcandles maintained at table level. Provide switching for several levels of lighting. Provide clock outlet. Provide electronic control of screen and projector.
Communications:	Wired to main computer, at least two outlets.

EQUIPMENT

Fixed:	Provide electrically operated projection screen. Provide open coat closet with hangers. Provide at least 20 lineal feet of chalkboard. Provide tackboards. Provide for modern audiovisual system. Provide enclosed (sliding area with small sink and 120 volt electrical outlets (kitchenette). Low speakers platform with audiovisual controls; conference modular tables and upholstered chairs.
Movable:	None

II. STAFF ROOMS AND LABORATORIES

Scientists Offices (8 x 150 square feet)	1,200	square	feet
Technicians Offices (3 x 200 square feet)	600	"	"
Graduate Student Offices (3 x 150 square feet)	450	"	"
Employees Lounge	400	"	"
Shower/Locker/Restrooms (2 x 200 square feet)	400	"	"
Epidemiology Workroom (2 x 200 square feet)	400	"	"
Immunology Suite	1,760	"	"
Microbiology Suite	1,760	"	"
Parasitology Suite	1,760	"	"
Pathophysiology Suite	1,760	"	"
Photo Dark Room	100	"	"
Laboratory Equipment/Storage Room	400	"	"
Dry Chemical Storage Room	150	"	"
Chemical Transfer Room	40	"	"
Total	11,180	"	"

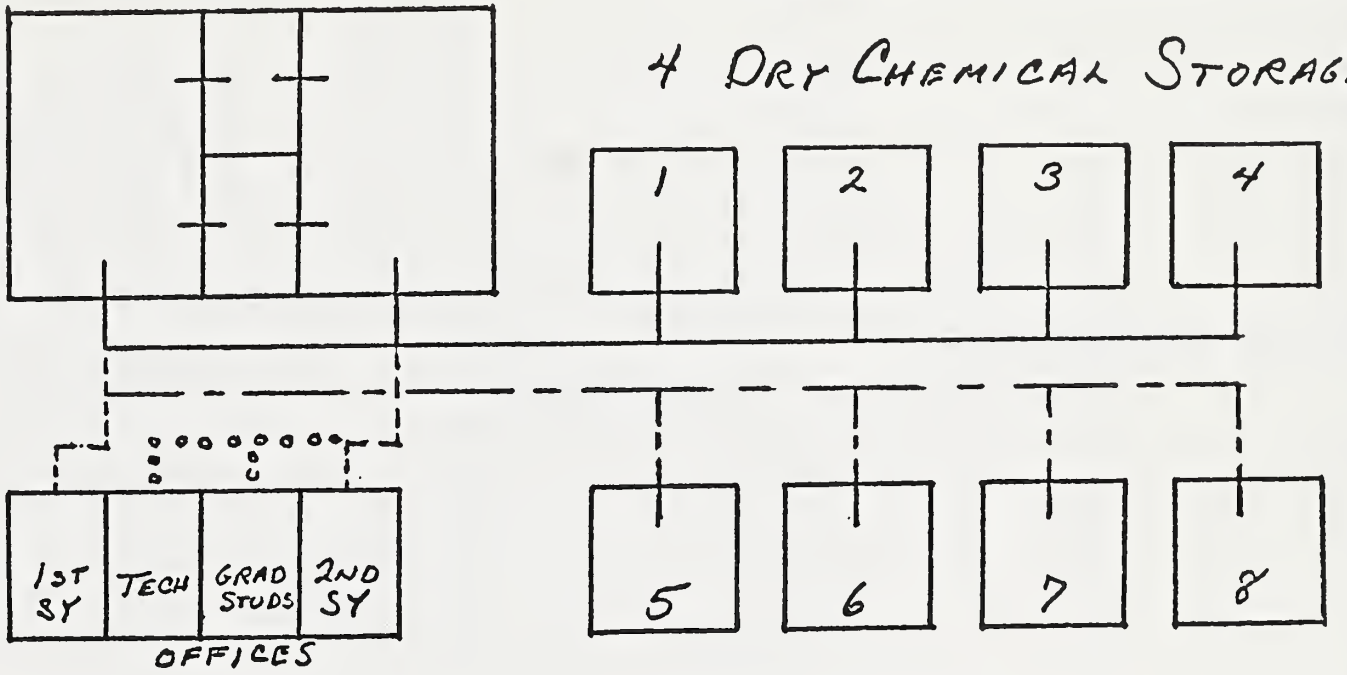
1 GLASSWARE/MEDIA PREP

2 EQUIPMENT ROOM

3 CHEMICAL TRANSFER RM

4 DRY CHEMICAL STORAGE

FUNCTIONAL UNIT



ASSOCIATIONS

—— PRIMARY

—·— SECONDARY

---- TERTERY

oooooo QUARTERNARY

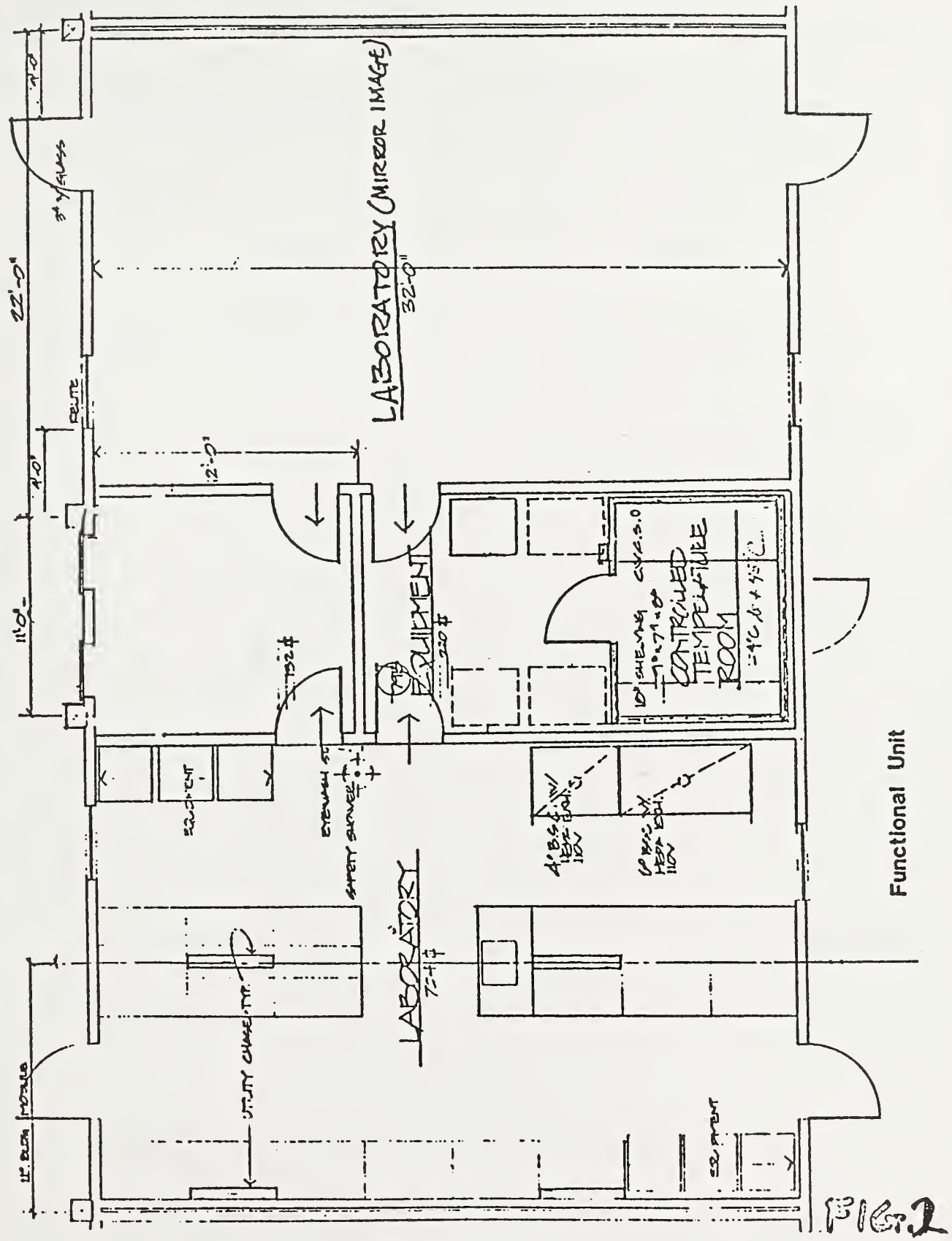
5 DARKROOM

6 LOCKER ROOM

7 EMPLOTEE LOUNGE

8 SECRETARY

A "functional unit" (see Figure 2) of 1,760 square feet (55' x 32') is recommended for laboratories that will accommodate two investigators and provide shared facilities for controlled environment rooms and equipment. Each lab is 704 square feet with a shared space of 252 square feet.


LABORATORY (MIRROR IMAGE)
32'-0"
EQUIPMENT
CONTROLLED TEMPERATURE ROOM
LABORATORY
EQUIPMENT
SAFETY SHOWER
EYEWASH
22'-0"
11'-0"
12'-0"
4'-0"
FIG. 2
Functional Unit
SCALE 0 1

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Office Space (Scientists)
REQUIREMENTS	
Number Required:	8
Number of Occupants:	1/Office
Net Area:	150 sq. ft.
Hours of Use:	10 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Paneling
Ceiling:	Acoustic or Drywall
Special Features:	Provide for noise reduction between offices.
ACTIVITY FUNCTION	This office will serve as the center for scientists' activities and should accommodate two visitors. It will be used for private discussions and to provide a space for program development away from the laboratory.
RELATIONSHIPS	Primary relationships to laboratory areas. Each scientist's office should be located close to his designated lab.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide fluorescent lighting, 50-60 footcandles maintained at desk level. Provide 120 volt convenience outlets.
Communications:	Provide telephone and computer line.

EQUIPMENT

Fixed:	Coat hooks on wall, 3' high x 5' wide chalkboard, 3' high x 5' wide tackboard.
Movable:	3-4 files, bookcases, credenza, work table, desk, and 3 chairs.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Office Space (Technicians)
REQUIREMENTS	
Number Required:	3
Number of Occupants:	4/Office
Net Area:	200 sq. ft.
Hours of Use:	8 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Painted
Ceiling:	Acoustic or Drywall
Special Features:	Provide for noise reduction between offices.
ACTIVITY FUNCTION	The space will serve as an office for technicians.
RELATIONSHIPS	Primary relationship to laboratory areas.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None
Electrical:	Provide fluorescent lighting, 50-60 footcandles maintained at desk level. Provide 120 volt convenience outlets.
Communications:	Provide telephone and 2 computer lines.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

EQUIPMENT

Fixed:	Coat hooks on wall, 3' high x 5' wide chalkboard, 3' high x 5' wide tackboard.
Movable:	Office furniture.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Office Space (Graduate Students)
REQUIREMENTS	
Number Required:	3
Number of Occupants:	2/Office
Net Area:	150 sq. ft.
Hours of Use:	10 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Painted
Ceiling:	Acoustic or Drywall
Special Features:	Provide for noise reduction between offices.
ACTIVITY FUNCTION	This space serves as the center for graduate student activity.
RELATIONSHIPS	Primary relationship to laboratory areas.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None
Electrical:	Provide fluorescent lighting, 50-60 footcandles maintained at desk level. Provide 120 volt convenience outlets.
Communications:	Provide telephone and computer lines.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

EQUIPMENT

Fixed:	Coat hooks on wall, 3' high x 5' wide chalkboard, 3' high x 5' wide tackboard.
Movable:	Office furniture.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Employees Lounge
REQUIREMENTS	
Number Required:	1
Number of Occupants:	15-25
Net Area:	400 sq. ft.
Hours of Use:	1-1/2 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Resilient
Base:	
Walls:	Washable surface
Ceiling:	Acoustic
Special Features:	
ACTIVITY FUNCTION	This room will function as a lunch room/coffee room/break space and should enhance cross-discipline interactions.
RELATIONSHIPS	Primary relationship to office and laboratory areas.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	Provide for hot water, cold water, and sink. Provide cold water and drain for plumbing of vending machines as required. Provide sink with drinking water or separate water cooler.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide 110 volt duplex convenience outlets and outlets for vending machines. Provide fluorescent lighting, 30-40 footcandles maintained at table top. Provide clock outlet.
Communications:	Provide telephone outlet.

EQUIPMENT

Fixed:	Domestic kitchen type sink with at least 10 feet of counter space with storage space beneath counter and wall cabinet above.
Movable:	Microwave and tables and chairs for 20 people.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Shower/Locker/Restrooms
REQUIREMENTS	
Number Required:	2
Number of Occupants:	Varies
Net Area:	200 sq. ft.
Hours of Use:	10 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Ceramic tile
Base:	
Walls:	Ceramic tile
Ceiling:	Drywall
Special Features:	One shower room designated as Women; one designated as Men
ACTIVITY FUNCTION	This space will provide storage facilities for clothes only and shower facilities.
RELATIONSHIPS	This space should be located adjacent to or incorporate with Men's or Women's toilet rooms.
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	Provide for hot and cold water and drain for shower.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide fluorescent lighting, 15-20 footcandles maintained at floor level. Provide vaporproof lighting in showers. Provide 110 volt convenience outlets for cleaning. Provide clock outlet.
Communications:	None

EQUIPMENT

Fixed:	Lockers (25 mens's and 10 women's).
Movable:	None

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Epidemiology Workrooms
REQUIREMENTS	
Number Required:	2
Number of Occupants:	2
Net Area:	200 sq. ft.
Hours of Use:	10 hours/day - 5 days/week
Access:	General
CONSTRUCTION	
Floor:	Carpet
Base:	Vinyl
Walls:	Drywall, Painted
Ceiling:	Acoustic
Special Features:	The primary uses of the computing equipment are: (1) Data acquisition; (2) Graphics to draw graphs, diagrams, etc; (3) Data reduction and analysis; and (4) Model simulation.
ACTIVITY FUNCTION	Evaluation of epidemiologic data.
RELATIONSHIPS	Direct access to offices.
SYSTEMS	
HVAC:	Okay to recirculate air. Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	None
Electrical:	Provide fluorescent lighting, 50-60 footcandles maintained at desk level. Provide 120 volt convenience outlets.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Communications:	Provide two telephone outlets and 2 computer lines.

EQUIPMENT

Fixed:	Coat hooks on wall, 3' x 5' chalkboard, 3' x 5' tackboard.
Movable:	3-4 files, bookcases, worktable, chairs, 2 computer terminals, "super" microcomputer.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Immunology Suite
REQUIREMENTS	
Number Required:	1
Number of Occupants:	4-6
Net Area:	1,760 sq. ft.
Hours of Use:	12 hours/day - 5 days/week
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	
Walls:	Washable surface
Ceiling:	Drywall
Special Features:	Provide chemical-resistant drains.
ACTIVITY FUNCTION	Wet laboratory dealing with immunology.
RELATIONSHIPS	
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	Provide hot, cold, DI water; air, gas, vacuum; reverse osmosis water for lab benches. Provide floor drains. Provide same services for hoods as for lab benches. Floor drain for safety shower.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide 110 volt duplex outlets at 2' intervals along laboratory benches. Provide at least six 208 volt, 1 Ø outlets. Provide fluorescent lighting, 60-70 footcandles maintained at bench level.
Communications:	Provide telephone and computer outlet.

EQUIPMENT

Fixed:	Provide services for large double sink at end of an island bench and small sink (14" x 17" x 12" deep) on wall bench. Provide wall cabinets or shelves above all benches. Provide 1 fume hood (4' bench-type) and 1 biological safety cabinet (6', Type IIB). Hoods should have 100 FPM face velocity. Provide a service for hood as for lab benches. Provide 90 lineal feet of 36" bench and 76 lineal feet of 30" bench space with varied storage capacity and sit down space below. Provide at least 16 lineal feet of floor space for movable equipment. Provide cup sinks (about 2) per 10 lineal feet of lab bench. Provide a controlled temperature room of about 100 square feet with temperatures -10 to +50°C or of a temperature range of similar range commercially available.
Movable:	Refrigerator, centrifuge, hot plate/stirrer, ovens, microscope, incubators.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Microbiology Suite
REQUIREMENTS	
Number Required:	1
Number of Occupants:	4-6
Net Area:	1,760 sq. ft.
Hours of Use:	12 hours/day - 5 days/week
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	
Walls:	Washable surface
Ceiling:	Drywall
Special Features:	Provide chemical-resistant drains.
ACTIVITY FUNCTION	Wet laboratory dealing with microbiology.
RELATIONSHIPS	
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	Provide hot, cold, DI water; air, gas, vacuum; reverse osmosis water for lab benches. Provide floor drains. Provide same services for hoods as for lab benches. Floor drain for safety shower.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide 110 volt duplex outlets at 2' intervals along laboratory benches. Provide at least six 208 volt, 1 Ø outlets. Provide fluorescent lighting, 60-70 footcandles maintained at bench level.
Communications:	Provide telephone and computer outlet.

EQUIPMENT

Fixed:	Provide services for large double sink at end of an island bench and small sink (14" x 17" x 12" deep) on wall bench. Provide wall cabinets or shelves above all benches. Provide 1 fume hood (4' bench-type) and 1 biological safety cabinet (6', Type IIB). Hoods should have 100 FPM face velocity. Provide a service for hood as for lab benches. Provide 90 lineal feet of 36" bench and 76 lineal feet of 30" bench space with varied storage capacity and sit down space below. Provide at least 16 lineal feet of floor space for movable equipment. Provide cup sinks (about 2) per 10 lineal feet of lab bench. Provide a controlled temperature room of about 100 square feet with temperatures -10 to +50°C or of a temperature range of similar range commercially available.
Movable:	Refrigerator, centrifuge, hot plate/stirrer, ovens, microscope, incubators.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Parasitology Suite
REQUIREMENTS	
Number Required:	1
Number of Occupants:	4-6
Net Area:	1,760 sq. ft.
Hours of Use:	12 hours/day - 5 days/week
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	
Walls:	Washable surface
Ceiling:	Drywall
Special Features:	Provide chemical-resistant drains.
ACTIVITY FUNCTION	Wet laboratory dealing with parasitology.
RELATIONSHIPS	
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	Provide hot, cold, DI water; air, gas, vacuum; reverse osmosis water for lab benches. Provide floor drains. Provide same services for hoods as for lab benches. Floor drain for safety shower.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide 110 volt duplex outlets at 2' intervals along laboratory benches. Provide at least six 208 volt, 1 Ø outlets. Provide fluorescent lighting, 60-70 footcandles maintained at bench level.
Communications:	Provide telephone and computer outlet.

EQUIPMENT

Fixed:	Provide services for large double sink at end of an island bench and small sink (14" x 17" x 12" deep) on wall bench. Provide wall cabinets or shelves above all benches. Provide 1 fume hood (4' bench-type) and 1 biological safety cabinet (6', Type IIB). Hoods should have 100 FPM face velocity. Provide a service for hood as for lab benches. Provide 90 lineal feet of 36" bench and 76 lineal feet of 30" bench space with varied storage capacity and sit down space below. Provide at least 16 lineal feet of floor space for movable equipment. Provide cup sinks (about 2) per 10 lineal feet of lab bench. Provide a controlled temperature room of about 100 square feet with temperatures -10 to +50°C or of a temperature range of similar range commercially available.
Movable:	Refrigerator, centrifuge, hot plate/stirrer, ovens, microscope, incubators.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Pathophysiology Suite
REQUIREMENTS	
Number Required:	1
Number of Occupants:	4-6
Net Area:	1,760 sq. ft.
Hours of Use:	12 hours/day - 5 days/week
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	
Walls:	Washable surface
Ceiling:	Drywall
Special Features:	Provide chemical-resistant drains.
ACTIVITY FUNCTION	Wet laboratory dealing with pathophysiology.
RELATIONSHIPS	
SYSTEMS	
HVAC:	Heating, cooling, and ventilation designed as indicated in Appendix.
Plumbing:	Provide hot, cold, DI water; air, gas, vacuum; reverse osmosis water for lab benches. Provide floor drains. Provide same services for hoods as for lab benches. Floor drain for safety shower.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide 110 volt duplex outlets at 2' intervals along laboratory benches. Provide at least six 208 volt, 1 Ø outlets. Provide fluorescent lighting, 60-70 footcandles maintained at bench level.
Communications:	Provide telephone and computer outlet.

EQUIPMENT

Fixed:	Provide services for large double sink at end of an island bench and small sink (14" x 17" x 12" deep) on wall bench. Provide wall cabinets or shelves above all benches. Provide 1 fume hood (4' bench-type) and 1 biological safety cabinet (6', Type IIB). Hoods should have 100 FPM face velocity. Provide a service for hood as for lab benches. Provide 90 lineal feet of 36" bench and 76 lineal feet of 30" bench space with varied storage capacity and sit down space below. Provide at least 16 lineal feet of floor space for movable equipment. Provide cup sinks (about 2) per 10 lineal feet of lab bench. Provide a controlled temperature room of about 100 square feet with temperatures -10 to +50°C or of a temperature range of similar range commercially available.
Movable:	Refrigerator, centrifuge, hot plate/stirrer, ovens, microscope, incubators.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Photo Dark Room
REQUIREMENTS	
Number Required:	1
Number of Occupants:	1
Net Area:	100 sq. ft.
Hours of Use:	10 hours/day - 5 days/week
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	
Walls:	Washable surface
Ceiling:	
Special Features:	Provide light tight condition at doors and at ceilings. Provide common light lock.
ACTIVITY FUNCTION	Will provide photographic development of film, photographic enlarging and printing.
RELATIONSHIPS	General access from all labs.
SYSTEMS	
HVAC:	Do not recirculate air. Heating, cooling, and ventilation.
Plumbing:	Provide hot and cold water to temperature controller. All water to be filtered.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Electrical:	Provide 110/208 volt outlets. Provide 110 volt outlets at 3' 1" O.C. with 2 circuits per room. Provide dark room safelights over bench with separate switching of white light and safelight at different mounting heights. Provide red indicator "In Use:" Sign at outside entry controlled by individual switch.
Communications:	Telephone outlet.

EQUIPMENT

Fixed:	Dark room tray developing sink approximately 7' long. Provide a dry bench approximately 10' long with lgith tight paper storage.
Movable:	Enlarger, dryer, and washer.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Laboratory Equipment/Storage Room
REQUIREMENTS	
Number Required:	1
Number of Occupants:	0
Net Area:	400 sq. ft.
Hours of Use:	Continuous
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	
Walls:	Washable surface
Ceiling:	
Special Features:	
ACTIVITY FUNCTION	This room will house the ultra-low temperature, low temperature, and LN2 freezers, and bulk storage of expendable supplies.
RELATIONSHIPS	General access from all labs.
SYSTEMS	
HVAC:	Provide heating, cooling, and ventilation design as indicated in Appendix with allowance for heat load from mechanical freezers and LN2 evacuation.
Plumbing:	Provide hot and cold water and sink.
Electrical:	Provide 110 and 208 volt outlets.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Communications:	Provide telephone.

EQUIPMENT

Fixed:	Small sink and shelves.
Movable:	Ultra-low temperature (-76°C), low temperature (-10°C), and LN2 freezers.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Dry Chemical Storage Room
REQUIREMENTS	
Number Required:	1
Number of Occupants:	0
Net Area:	150 sq. ft.
Hours of Use:	Continuous
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	Raised sills at doors for spill control.
Walls:	Washable surface
Ceiling:	
Special Features:	Meet OSHA requirements for dry chemical storage.
ACTIVITY FUNCTION	Storage room for dry chemicals and gas cylinders.
RELATIONSHIPS	General access from all labs.
SYSTEMS	
HVAC:	Provide heating, cooling, and ventilation design as indicated in Appendix.
Plumbing:	Safety shower, eyewash, and floor drain.
Electrical:	Provide explosion proof lighting, 60-70 footcandles maintained at bench level.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Communications:

EQUIPMENT

Fixed: Holders for gas cylinders and storage shelves.

Movable:

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

SPACE DESIGNATION	Chemical Transfer Room
REQUIREMENTS	
Number Required:	1
Number of Occupants:	0
Net Area:	40 sq. ft.
Hours of Use:	Continuous
Access:	Scientists, technicians, and graduate students.
CONSTRUCTION	
Floor:	Resilient
Base:	Raised sills at doors for spill control.
Walls:	Washable surface
Ceiling:	
Special Features:	Meet OSHA requirements for acids, bases and solvents.
ACTIVITY FUNCTION	Transfer of chemicals from storage to laboratories.
RELATIONSHIPS	General access from all labs.
SYSTEMS	
HVAC:	Do not recirculate exhaust air. Heating, cooling, and ventilation design as indicated in Appendix.
Plumbing:	Provide hot and cold water. Provide floor drain.
Electrical:	Provide explosion proof lighting, 60-70 footcandles maintained at bench level.

ANIMAL HEALTH SYSTEMS RESEARCH LABORATORY
Space Data Sheet

Communications:

EQUIPMENT

Fixed:	None
Movable:	Chemical storage cabinets.

APPENDIX

GUIDELINES FOR MECHANICAL AND ELECTRICAL ENGINEERING

As this building will be located at MARC, this facility must conform to certain established standards. These are enumerated below as they apply to specific areas of concern that may influence the designer's systems and methods of installation. Should the consultant find some areas where he can visualize savings in costs, operations, or energy consumption, he is encouraged to discuss these as they may well offer alternative means that may be incorporated into the project. Staff of the Agricultural Research Service will always be available for consultation to assure that the consultant's concerns are answered, or guidelines modified where necessary.

A. Air Conditioning Engineering, General

Experience and maintenance efforts with existing facilities have resulted in standards of materials and performance that offer the maximum use from the facilities with a minimum of continued replacement or repair.

Air Conditioning

Where an air-conditioned environment is indicated for administrative functions, the following conditions of dry- and wet-bulb temperatures will be used: summer 78°F dry-bulb and no humidity control with the outside conditions at 95°F dry-bulb and 75°F wet-bulb. Where an air-conditioned environment is indicated for research laboratory functions, the following conditions of dry- and wet-bulb temperatures will be used: summer 89°F dry-bulb and 68°F wet-bulb interior design with the outside conditions at 95°F dry-bulb and 75°F wet-bulb. The interior dew point must never exceed 60°F; winter 68°F dry-bulb. The cooled space and all cooling components should be designed to provide an acceptable sound level (including compressors, fans, pumps, cooling tower, piping, etc.). Unless the consultant possesses a sound knowledge of acoustics and vibrations, a special consultant must be retained for the sound and vibration. A normal minimal vibration isolation efficiency of 95 percent is considered the standard goal. The spaces and mechanical equipment should be coordinated to produce a sound level normally acceptable for the specific use of the space. Each assigned area will be provided with a system allowing for individual room controls. Some areas, such as computer facilities and special research areas, may require air-conditioned environments beyond that noted above, and required to operate throughout the year, thus requiring additional special considerations.

B. Air Conditioning Laboratory-type Space

Only specified elements for the programmed space should be mechanically cooled. Laboratory-type space is considered special. No human comfort cooling for office-type space will be allowed. For laboratory cooling, functional environmental conditions (special laboratory condition excepted

where required) are to be followed for the design of any air-conditioning system for these facilities.

Special conditions must not be allowed to slip beyond the required design conditions. Each space is to be furnished with its own temperature control.

All laboratory- and research-type space is to be designed for a minimum equipment loan of 10 watts/square feet. All air required for exhausting laboratory fume hoods is to be supplied directly to the room where the respective hood is located.

C. Heating Guidelines

1. Rollomatic filters should be employed for air conditioning whenever a viscous impingement filter is required for standard human comfort conditions. Rollomatic-type with manual wind and no time switch or other automatic devices. All filter mounts are to be universal, handle American Air Filter, Cambridge, or Continental media without any major change and at no additional cost.

2. All air-handling unit (AHU) coils used for heating, preheat, heat, and reheat are to employ steam. Freeze-stat on all outside air intakes. All booster reheat coils may be either hot water or steam.

3. Normal 50-75 psig steam supply pressure, saturated.

4. 150 psig steel valves on steam supply.

5. Pneumatic control. Use 20 psig local (in building) control air supply with refrigerated drier.

6. Elapsed time meters and amp meters on water chillers and refrigerant systems.

7. Piping system identification to be by the use of arrows and lettering on the pipe or insulation rather than by color code. The identification is to be stenciled directly on the finished line with black paint.

8. Wall-mounted room thermostats are to be provided with a tamper-proof cover fastened to the instrument frame by special screws of the style that consists of an eccentric pin hole in a solid head similar to those furnished by Johnson Control. Concealed temperature adjustment.

9. Use only drip-pan elbows on steam relief vent lines and not an additional exhaust head.

10. Ventilate all mechanical equipment rooms, elevator penthouses, and domestic water heater areas. Employ an independent ventilation fan

operator by a temperature control. The ventilation is to be accomplished with outside air, filtered. Normally a minimum capacity of 20 air changes is expected.

11. Specify a value for the upper- and lower-temperature limits for each thermometer application.

12. Specify a value for the upper and lower pressure for each pressure gauge application.

    a. Gauges are to be 3-1/2" face manufacturer's quality range such as Marsh "Quality or Trerice No. 600 Series" with bronze bushed movement and recalibrator in the face of the gauge, flat glass, slip-on steel ring, and pressed steel cast aluminum case.

13. On all equipment involving heat transfer, air, water, or other fluid, specify a minimum amount of heat transfer surface area and an appropriate TEMA surface fouling factor.

14. On all field fabricated refrigerant piping, specify a field pressure test and evacuation procedure, which must be witnessed by the engineer before refrigerant can be charged into the system.

15. Specify that all air quantities must be balanced to within plus or minus 10 percent of the values shown in the specifications or on the plans.

16. Specify that three copies of normal, final system balance test data are to be provided.

    For the following the test date will show:

    a. Air
        1. Temperatures, °F
        2. Quantity, cfm
        3. Pressures, inches of water

    b. Water and other liquids
        1. Temperatures, °F
        2. Pressures, psig
        3. Pressure differences across equipment, psi
        4. Flow rate gpm, lb/min or cfm

    c. Motors
        1. Nameplate rating
            (a) Manufacturer, frame, part number, and phase
            (b) Current
            (c) Speed
        2. Running current
        3. Running voltage
        4. Running speed

d. Fans
   1. Manufacturer, model, and serial number
   2. Nameplate rating
   3. Speed at each step of balance
   4. Pressure difference, inches of water at each step of balance

17. Each equipment drive shall be completely specified by the respective consulting engineer. If belt drive equipment must be furnished, special consideration must be given to the pulleys and belts to secure a drive, which will be approved by the manufacturer. All belt drives shall have a 1.75 service factor.

18. Automatic drain and make-up water shut-off on cooling tower sump and exterior lines (see item 27).

19. Devote a paragraph of the specification to describe the general design of the cooling and heating system listing design temperatures, interior and exterior and summer and winter.

20. An indicating thermometer is to be furnished with each control valve and on discharge air, mix air, and outside air.

21. Specify adequate temporary heat to avoid the use of building air handling and exhaust system during construction periods for research facilities, laboratories, etc., and consider advisability for all other buildings.

22. Avoid the use of unit heaters wheneve possible and under no circumstance is hot water to be used in the coil of a unit ventilator.

23. Specify the minimum condensate drain line size from any air-conditioning unit or refrigeration unit.

24. Instantaneous-type hot water heater, Aerco, Brade, or Patterson-Kelley required.

25. All electric motors must be NEMA approved and be furnished with ball bearings and cast iron end bells.

26. All pipe and duct chases are to be curbed. All pipe sleeves are to extend a minimum of 1" above the finished floor; sleeve material is to be galvanized pipe, full weight. In the floor, all cored holes are to be sleeved and caulked watertight. Space around pipes is to be sealed as required by UBC.

27. All cooling and heating coils, aluminum fins, and copper tube must have no more than 10 fins per inch on any coil.

28. Normal laboratory steam is to be furnished with a needle valve to allow throttling. Steam pressure in laboratory is not to exceed 5 psig.

D. Chemical Fume Hood Design

1. Absolute, average, minimum face velocity - 100 fpm. This value must be measured at the face of the fume hood in the plane of the sash with the door open to a working opening stop (for carcinogenic use, comply 150 fpm instead of 100 fpm).

2. Maximum air quantity, based on the actual open area with the fume hood sash completely open is to be specified. Naturally, various manufacturer's face areas vary, and as such the minimum face velocity will be slightly lower or higher than the actual quantity of air contemplated and calculated in the design of the air-conditioning system. For instance, a 6' hood will have an approximate 5' 6" width and 2' 6" height (fully open) or roughly 13.75 square feet area for total maximum air of 1,400 cfm. A loss around the bypass will exist, say 10 percent or 140 cfm; a loss as the constant flow under the sash still to scavenge the fume hood when the sash is closed, say 100 cfm; for the quantity of air remaining for actual fume control in the open sash, or maximum of 1,160 cfm that is equivalent to approximately 85' per minute face velocity, using the 13.75 square feet value for sash-free area. Actually, the sash-free area is typically 12.5 square feet for a normal 6' fume hood, which is equivalent to a face velocity of 93 fpm.

3. Specify a pressure drop maximum - from the entrance into the hood to the outlet usually at the top or back of the hood. With the pressure drop, specify total equivalent area or equivalent round diameter duct, which will allow an air velocity of less than 1,600 fpm for all of the air entering through the hood.

   The maximum pressure loss for all air entering into the hood and out of the outlet or outlets provided is not to exceed 1/4" W.G. This pressure drop is to correspond to the maximum air quantity specified for the hood.

4. A readily accessible pvc volume damper for balancing the air in the discharge duct of the fume hood is to be employed. Volume damper on a nylon shaft.

5. Provide an adequate exhaust fan selected on the generous side of capacity limits; and specify the responsibility for balancing and rebalancing the fume hood system and air. Responsibility is to lie directly with the heating and ventilating contractor who is to work with the balancing contractor. The fume hood supplier must have clearly defined responsibility limits.

6. Show a schedule of the fume hoods in the specification covering the following:

   a. Room number in which the fume hood is located.

   b. Exhaust fan number to which the hood is attached.

c. Nominal size of the fume hood, face width and height.

d. Maximum air quantity moved through the fume hood, total.

e. Minimum outlet size for duct connection to the fume hood.

7. Fume hood exhaust ducts constructed of type 316 corrosion-resistant steel.

a. All fume hood exhaust duct work is to be under negative pressure relative to its surrounding area.

b. All seams to be welded except at the outer end where fan shall be located.

8. See S&E Manual 232.1, Laboratory Chemical Fume Hood Standards.

E. Biological Safety Cabinets Class IIB

National Sanitation Foundation Standard 49, Published 1983, Class II (lamino floor) Biohazard Cabinetry, Ann Arbor, Michigan.

F. Lighting and Power Circuits and Communication

1. A room is to be provided for signals and communications. This signal and communication room will house the centrex telephone system panel and fire alarm system. The minimal requirements are normally 64 square feet with a long room for maximum wall space.

2. Dependent on the quantity of electrical equipment (300 to 500 KVA), a two-voltage distribution system is desired. Normally a four-wire, 480/277 volt, three-phase (grounded neutral) system is required. Automatic forced air (fan cooled) transformers are to be considered if dry-type transformers are employed. All interior transformers shall be dry-type.

3. Circuit breakers on the main feeders are required (no disconnect switches).

4. Normally provide for two incoming high-voltage feeders to the transformer vault with appropriate switches.

5. Provide lighning arrestors on exterior, dry-type transformers to protect them from switching surges. Employ the arrestors at the terminals of the transformer (employ rotating machinery-type arrestors).

6. All transformer vaults must be mechanically ventilated employing outside air. The supply fan must be operated automatically by a room-temperature control and must be sized to provide a minimum of 3 percent of the transformer capacity heat removal based on a 10°F temperature difference.

7. Circuit breaker numbering system - consecutive numbers for each space. Wires out of one conduit in consecutive order.

8. Use Wiremold No. 3000 for combination, three-phase, single-phase 208-volt and 120-volt with grounder wire - 5 wires for three-phase, 4 wires for single phase 208, and 3 wires for 120-volt.

9. For future electrical capacity, we suggest the installation of an empty conduit through the floor to the respective circuit breaker panel box and from the box to the space above the furred ceiling of the corridor. It is assumed a pull box would be installed at each remote end of the empty conduit. This would allow installation of future circuits with ease and will be most important in the research areas of our facilities.

10. For the routing of signal and communication cable (telephone included) in multistory buildings, cable is to be run exposed in enlarged duct and pipe chases with terminal boards on each floor of the chase. Terminal boards are to be plywood sheets, 3/4" x 4' x 8' or sized as required, painted gray with 120-volt duplex outlet on every other panel. Minimum depth of chase in 18". Note: fire department may restrict the use of chase and/or require them to be packed at each floor level. From terminal board on each floor, exposed cable is to be run in furred corridor ceilings in trays to individual room conduit stubbed from the room to the ceiling above the corridor. Room conduit shall be sized minimum 3/4" or larger as required. Note: this requires the open space above the ceiling MUST NOT BE A PLENUM.

    Connection boxes are to be installed in every normally occupied room, one in each inside wall that is perpendicular to an outside wall. Connection boxes are to be large enough to house the telephone connector. Connection box is to be minimum 5" square box, 2-1/2" deep. Provide full openings to room, no smaller plaster covers. Connection box covers full size, are to be stainless steel plates with stamped outlets large enough to pass the telephone connector. Stamped outlet is to be 1-1/2" high and 3/4" wide, rectangular opening.

11. For duplex outlets, employ Hubbel No. 5262 for 15-amp and 5462 for 20-amp service, all specification grade.

12. For 208-volt outlets, employ Hubbel No. 630R for single phase, 30-amp and No. L1530R for three phase, all specification grade, or equal quality.

13. For switches, employ Hubbel No. 1201, 15 amp and No. 1223, 20 amp, all specification grade, or equal quality.

14. Each control system provided on any sort of equipment should have a fused control circuit.

15. All pipe and duct chases are to be curbed. All pipe sleeves are to extend a minimum of 1" above the finished floor; sleeve material is to be galvanized pipe, full weight. In the floor, all cored holes are to be sleeved and caulked watertight. All space is to be sealed after caulking.

F. Lighting Levels

1. The basic lighting requirements are as follows, with special purpose lighting to be recommended by the consultant, unless noted otherwise in program detail.

   a. Offices - administration, staff and general, mailrooms, conference rooms, etc.: fluorescent lighting, maintain 50-60 footcandles at desk height.

   b. Laboratories: fluorescent lighting, maintain 60-75 footcandles at bench height.

   c. Service rooms (shops, reproduction rooms, etc.): fluorescent light, maintain 60-75 footcandles at bench height.

   d. Corridors, lobbies, etc.: fluorescent lighting, except for displays, maintain 15-20 footcandles at floor level.

   e. Toilet rooms: fluorescent lighting, maintain 10-15 footcandles at floor level.

   f. Janitor's closets: incandescent lighting, minimum 10-15 footcandles.

   g. Storage rooms: fluorescent lighting, maintain 10-15 footcandles at floor level.

   h. Galleries and other special areas are to be lighted as required after analysis by the architect.

   i. Solvent storage: incandescent lighting, maintain 15-20 footcandles at floor level. Explosion-proof fixtures and all electric wiring shall conform to NBFU Bulletin 70.

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